RECORD OF DECISION

SUTTON BROOK DISPOSAL AREA SUPERFUND SITE

TEWKSBURY, MASSACHUSETTS

MIDDLESEX COUNTY

SEPTEMBER 2007

Prepared by:

United States Environmental Protection Agency
New England Region – Region 1
One Congress Street
Suite 1100 (HBO)
Boston, Massachusetts 02114

PART 1: THE DECLARATION

A. STATEMENT OF BASIS AND PURPOSE

B. ASSESSMENT OF SITE

C. DESCRIPTION OF SELECTED REMEDY

D. STATUTORY DETERMINATIONS

E. SPECIAL FINDINGS

F. ROD DATA CERTIFICATION CHECKLIST

G. AUTHORIZING SIGNATURE

PART 2: THE DECISION SUMMARY

A. SITE NAME, LOCATION AND BRIEF DESCRIPTION

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. History of Site Activities
2. History of Federal and State Investigations and Removal and Remedial Actions
3. History of CERCLA Enforcement Activities

C. COMMUNITY PARTICIPATION

D. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

E. SITE CHARACTERISTICS

F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

1. Land Uses
2. Groundwater Uses

G. SUMMARY OF SITE RISKS

1. Human Health Risks
2. Ecological Risks

3. Basis for Response Action

H. REMEDIATION OBJECTIVES

I. DEVELOPMENT AND SCREENING OF ALTERNATIVES

J. DESCRIPTION OF ALTERNATIVES

1. Source Control (SC) Alternatives Analyzed

2. Management of Migration (MM) Alternatives Analyzed

K. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

L. THE SELECTED REMEDY

M. STATUTORY DETERMINATIONS

N. DOCUMENTATION OF SIGNIFICANT CHANGES

O. STATE ROLE

PART 3: THE RESPONSIVENESS SUMMARY

A. Questions and Comments Regarding Consolidation of Soils from Other Areas and Capping of the Landfill Lobes

B. Questions and Comments Regarding the Approach to Groundwater Cleanup

C. Questions and Comments Regarding the Scope of the Remedial Investigation and Feasibility Study (RI/FS)

D. Questions and Comments Regarding Liability, Enforcement, and the Timetable for Remedy Implementation

APPENDICES

Appendix A: State DEP Letter of Concurrence

Appendix B: Groundwater Use and Value Determination

Appendix C: Figures

Appendix D: Tables

Appendix E: Administrative Record Index and Guidance Documents

DECLARATION FOR THE RECORD OF DECISION

Sutton Brook Disposal Area
Tewksbury, Massachusetts
CERCLIS No. MAD980520696

A. STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Sutton Brook Disposal Area Site (Site), in Tewksbury, Massachusetts, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. § 9601 et seq., and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300 et seq., as amended. The Director of the Office of Site Remediation and Restoration (OSRR) has been delegated the authority to approve this Record of Decision.

This decision was based on the Administrative Record, which has been developed in accordance with Section 113(k) of CERCLA, and which is available for review at the Tewksbury Public Library and at the United States Environmental Protection Agency (EPA) Region 1 OSRR Records Center in Boston, Massachusetts. The Administrative Record Index (Appendix E to the ROD) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

The Massachusetts Department of Environmental Protection, as representative for the Commonwealth of Massachusetts, concurs with the Selected Remedy.

B. ASSESSMENT OF THE SITE

The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

C. DESCRIPTION OF THE SELECTED REMEDY

This ROD sets forth the selected remedy for the Sutton Brook Disposal Area Site, which involves the treatment of contaminated groundwater, the containment of groundwater, the excavation and containment of contaminated soils and sediments, and the containment of landfill waste, to prevent risks to potential future residents and facility workers and to protect terrestrial and aquatic wildlife. The remedy also requires institutional controls to prevent exposure to contaminated media prior to cleanup levels being achieved as well as to protect constructed components of the remedy. The selected remedy is a comprehensive approach for this Site that addresses all current and potential future risks caused by soil, groundwater, surface water and sediment contamination. Specifically, this remedial action addresses contaminated soils in the

Garage and Storage Area and the Former Drum Disposal Area, contaminated groundwater throughout the Site outside of the landfill lobes, and surface water and sediments in Sutton Brook directly between the landfill lobes. The remedial measures will ensure that: groundwater throughout the Site will no longer present an unacceptable risk to future residents or future facility workers via ingestion or inhalation and will be suitable for consumption; the soils at the Site (Garage and Storage Area) will no longer present an unacceptable risk to future residents via direct contact and will be suitable for unrestricted use; presumed risk from contact with landfill waste will be eliminated; soils at the Site (Former Drum Disposal Area) will no longer be a source of groundwater contamination; ongoing impacts to groundwater from landfill waste, will be reduced or eliminated; and restoration of impacted brook sediments and surface water will provide protection of ecological receptors.

The major components of this remedy are:

- Excavation of contaminated soils and sediments above site specific cleanup levels (soils at the Garage and Storage Area and the Former Drum Disposal Area, and contaminated sediments from Sutton Brook between the landfill lobes);
- Consolidation of excavated soils, sediments, and debris into the landfill;
- Construction of a multi-layer impermeable cap over the landfill lobes;
- Interception of groundwater from the southern lobe;
- A combination of collection and treatment and monitored natural attenuation for contaminated groundwater;
- Institutional controls; and
- Long-term monitoring.

This is a comprehensive remedy. There are no Operable Units at this Site.

The selected response action addresses principal and low-level threat wastes at the Site by: treating and containing groundwater to address principal threat wastes; containing landfill waste to address principal threat wastes; and excavating and containing contaminated soils and sediments to address principal and low-level threat wastes.

D. STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action (unless justified by a waiver), is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduce the toxicity, mobility, or volume of materials comprising principal threats through treatment).

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure (and groundwater and/or land use restrictions are necessary), a review will be conducted within five years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

E. SPECIAL FINDINGS

Issuance of this ROD embodies specific determinations made by the Regional Administrator's delegee, the Director of the Office of Site Remediation and Restoration, pursuant to CERCLA and Section 404 of the Clean Water Act, 33 U.S.C. § 1344, that the remedy is the least damaging practicable alternative for protecting aquatic ecosystems at the Site under the standards of 40 C.F.R. Part 230. Specifically, at the landfill lobes, EPA expects impacts to both wetlands and the 100-year floodplain. At the landfill lobes, EPA proposes capping the waste in place, and excavating contaminated sediments between the landfill lobes which will result in extensive disturbances to these already impacted wetlands. The potential need for replacement floodplain storage capacity will be addressed during the design process and alteration of wetlands will be addressed through mitigation measures. Due to the proximity of the landfill lobes to this wetland area, as well as the existing sediment contamination, and the need to provide the proper slopes for the landfill cap, EPA cannot identify a less damaging practicable alternative for the remedy which would avoid impacts to the aquatic environment while adequately addressing site risks.

F. ROD DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this Site.

1. Chemicals of concern (COCs) and their respective concentrations

2. Baseline risk represented by the COCs

3. Cleanup levels established for COCs and the basis for the levels

4. Current and future land and ground-water use assumptions used in the baseline risk assessment and ROD

5. Land and groundwater use that will be available at the Site as a result of the selected remedy

6. Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected

7. Decisive factor(s) that led to selecting the remedy

8. The selected response action addresses principal and low-level threat wastes at the Site by: treating and containing groundwater to address principal threat wastes; containing landfill waste to address principal threat wastes; and excavating and containing contaminated soils and sediments to address principal and low-level threat wastes.

G. AUTHORIZING SIGNATURE

This ROD documents the selected remedy for soils, groundwater, surface water and sediments at the Sutton Brook Disposal Area. This remedy was selected by EPA with concurrence of the Massachusetts Department of Environmental Protection.

Concur and recommended for immediate implementation:

U.S. Environmental Protection Agency

By: ______________________ Date: 9.27.07

James T. Owens, III
Director
Office of Site Remediation and Restoration
Region 1

A. SITE NAME, LOCATION AND BRIEF DESCRIPTION

Sutton Brook Disposal Area Superfund Site
South Street
Tewksbury, MA

CERCLIS Number: MAD980520696

US EPA is the lead agency

Sutton Brook Disposal Area is primarily a landfill

Site Description

The Sutton Brook Disposal Area, referred to during most of its history as the Rocco's Landfill or Tewksbury Town Dump, is located on approximately 100 acres of land off South Street on the eastern boundary of the Town of Tewksbury, Middlesex County, Massachusetts. A small portion of the landfill also extends into the Town of Wilmington. Two major source areas exist on the Site: the Landfill Lobes, which include the Northern Lobe and Southern Lobe; and the Former Drum Disposal Area (FDDA). The Landfill Lobes comprise about 40 acres of the Site. In 2000, between 300 and 400 buried drums were removed from the FDDA, which is located outside the southwest edge of the Northern Lobe. Sutton Brook (and associated wetlands) flows east to west through the property. Sutton Brook itself divides the landfill into the Northern and Southern lobes. Additional wetland areas are located south of the landfill and along the eastern and western portions of the property.

A more complete description of the Site can be found in Section 1 of the Remedial Investigation Report (Woodard & Curran, 2007).

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

1. History of Site Activities

Waste disposal activities at the Site can be traced back to at least 1957, when the Town of Tewksbury Board of Health designated the property as a dumping area. Until approximately 1988, the Rocco's Landfill (which is roughly synonymous with the Site) accepted municipal, commercial, and industrial wastes from both inside and outside of the Town of Tewksbury, including unknown quantities of hazardous substances.

A more detailed description of the Site history can be found in Section 1 of the Remedial Investigation Report.

2. History of Federal and State Investigations and Removal and Remedial Actions

The Site was proposed to the National Priorities List (NPL) in July of 2000, and the Site's NPL listing was finalized in June of 2001. As discussed below and shown in the following table, numerous investigations have taken place during the history of the Site.

In 1983, the Massachusetts Department of Environmental Protection (MassDEP) inspected the landfill and took a number of samples of water from a brook within the boundaries of the Rocco property. The MassDEP analysis showed the presence of organic compounds in the samples taken on Rocco property downstream of the landfill, and it was determined that the cause of the contamination was the groundwater from the landfill.

EPA issued a Site Inspection Report, on August 15, 1991, using available State and EPA file information, interviews with local officials, and information gathered during on-site reconnaissance and environmental sampling efforts. The Site Inspection Report identified the need for continued investigation of the landfill to determine whether it could be eligible for inclusion on the NPL.

As an interim measure, the Site was referred to the Removal Program for an assessment of the public health concerns and the potential for a response action. Based on sampling and analysis conducted by the Removal Program in 1992, coupled with the evaluation provided by the Agency for Toxic Substances and Disease Registry (ATSDR), a determination was made that an immediate health threat did not exist at that time, and a removal action was not warranted. The MassDEP remained the lead agency for monitoring conditions at the Site.

In May of 1999, the MassDEP received information that drums had been buried at the landfill. In response, the MassDEP conducted a magnetometer survey of areas outside the footprint of the landfill for evidence of buried metal objects. A number of "magnetic anomalies" were detected and a backhoe was used to dig test pits to see if the areas contained metal drums. Only one area was found to contain drums. Approximately 60 crushed metal drums were discovered, with the surrounding soils found to be contaminated with hazardous materials, including but not necessarily limited to, toluene, xylene, and phthalates.

In early June 1999, the MassDEP installed groundwater monitoring wells near the area where the crushed drums were discovered. Sampling results showed that groundwater in the vicinity where the drums were found was contaminated with the same hazardous materials found in the overlying soils.

At the request of the MassDEP, the EPA Removal Program conducted a preliminary assessment/site investigation (PA/SI) to supplement information gather by the MassDEP from July 26, 1999 through August 11, 1999. EPA concluded that a removal action was warranted in a Site Investigation Closure Memorandum dated August 10, 1999.

Following mobilization of equipment and personnel and Site preparation activities, soil excavation began on July 20, 2000. Excavation of contaminated soils, drums, and containers was completed on November 13, 2000. As the soils were excavated, they were staged into two stockpiles based on photoionization detector (PID) readings, visible observation, and on-site screening for volatile organic compounds. The larger of the two piles was limited to soils. Contaminated debris, visibly contaminated soils, and soils which registered higher concentrations and/or PID readings were placed into the smaller of the two piles. Both piles were secured with tarpaulins while transportation and disposal arrangements were finalized.

On December 18, 2000, four roll off boxes containing empty drums, drum parts, and used personal protective equipment were shipped off-site for landfill disposal. Transportation of the soils from the larger of the two piles for off-site treatment and disposal was also initiated on that date. On February 19, 2001, the last four truckloads of soils from the larger pile were shipped off-site for treatment and disposal. A total of approximately 10,000 tons of soils was shipped for thermal desorption treatment and disposal.

On October 10, 2001, EPA issued a Unilateral Administrative Order (UAO) for removal. Under this UAO, a group of PRPs completed the removal of the remaining contaminated soil pile at the Site by February, 2002.

Date	Action	Who Undertook	Results	Related Documents
1989	Sampling	EPA	11 Soil Samples, 3 Sediment Samples	Report
1992	Air Sampling	EPA	7 Ambient Air Samples	Tech Memo
1996	Initial Site Assessment	MassDEP	Landfill Gas Samples, Groundwater Samples Sediment Samples Surface Water Samples	Report
1999	Preliminary Assessment/ Site Investigation	EPA	Soil Samples	Report
1999	Site Investigation Closure Memo	EPA	Documented that a Removal Action was Warranted	Memorandum
2000	Preliminary Data Report Sampling	MassDEP	Groundwater and Surface Water Sampling	Report

2000	Action Memo	EPA	Initiated Removal Action	
2000	Final Trip Report	EPA	Groundwater, Soil, Wetland Soil, Sediment, and Surface Water Samples	Report
2001	Preliminary Assessment	EPA	Soil samples – Bemis Circles	Report
2001	Data Evaluation	EPA	Groundwater Sampling	Technical Memorandum
2002	Completion of Work Report	EPA	Post-Excavation Soil Samples	Documented Completion of the Removal Action
2002	Sampling	USGS	Passive Vapor Diffusion and Surface Water Samples	Report
2002	Sampling	Perkins Development Trust	Groundwater and Soil Samples	Application for Downgradient Property Status

3. History of CERCLA Enforcement Activities

On April 18, 2000, July 27, 2000 and June 22, 2001, EPA notified 12 potentially responsible parties ("PRPs") of their potentially liability at the Site. Responsible parties under CERCLA include persons who are current or former owners and/or operators of a site, persons who arranged for disposal of hazardous substances at a site (often called "generators"), or persons who accepted hazardous substances for transport to a site selected by such persons (often called "transporters"). On October 10, 2001, EPA issued a Unilateral Administrative Order (UAO) to the 12 noticed PRPs to complete the removal action that was initiated by EPA in 2000. Eight PRPs complied with the UAO to dispose of stockpiled contaminated soils at an off-site location. On May 10, 2002, EPA notified 31 additional PRPs of their potential liability at the Site, and in a special notice letter, EPA invited the 43 noticed PRPs to participate in formal negotiations with EPA to perform or finance the Remedial Investigation/Feasibility (RI/FS). On October 25, 2002, EPA sent letters to four of the previously noticed PRPs conditionally withdrawing notice of potential liability. In February 2004, EPA reached an agreement with 27 PRPs to conduct the RI/FS at the Site with EPA oversight. These PRPs have been active in the remedy selection process, having performed the RI/FS and submitting comments on the Proposed Plan during the public comment period. On August 31, 2007, EPA notified 23 additional PRPs of their potential liability at the Site

C. COMMUNITY PARTICIPATION

Throughout the Site's history, community concern and involvement has been high. EPA has kept the community and other interested parties apprised of Site activities through informational meetings, fact sheets, press releases and public meetings. Below is a brief chronology of public outreach efforts.

- On July 11, 2001, EPA held an informational meeting to discuss plans for the Site, following the final listing of the Site on the National Priorities List (NPL).

- In the summer of 2002 EPA gathered information and conducted interviews with representatives of the Town of Tewksbury and community members in order to develop a Reuse Assessment for the Site. The Reuse Assessment was prepared September, 2002.

- In December 2002, the EPA released a community relations plan that outlined a program to address community concerns and keep citizens informed about and involved in remedial activities.

- On May 12, 2004, EPA held an informational meeting to discuss the plans for the RI/FS and the settlement with a group of PRPs to perform the RI/FS under EPA oversight.

- On June 15, 2007, EPA published a notice and brief analysis of the Proposed Plan in the Lowell Sun, and made the plan available to the public at the Tewksbury Public Library located at 300 Chandler Street, Tewksbury, MA.

- On June 20, 2007 EPA made the administrative record available for public review at EPA's offices in Boston and at the Tewksbury Public Library located at 300 Chandler Street, Tewksbury, MA. This will be the primary information repository for local residents and will be kept up to date by EPA.

- On June 27, 2007, EPA held an informational meeting to discuss the results of the Remedial Investigation and the cleanup alternatives presented in the Feasibility Study and to present the Agency's Proposed Plan to a broader community audience than those that had already been involved at the Site. At this meeting, representatives from EPA and the PRPs answered questions from the public.

- From June 28 to July 28, 2007, the Agency held a 30 day public comment period to accept public comments on the alternatives presented in the Feasibility Study and the Proposed Plan and on any other documents previously released to the public.

- On July 18, 2007, the Agency held a public hearing to discuss the Proposed Plan and to accept any oral comments. A transcript of this meeting and the comments and the

Agency's response to comments are included in the Responsiveness Summary, which is part of this Record of Decision.

- Local residents formed an organization entitled T.O.X.I.C., Inc. to monitor Site activities. They applied for a TAG grant on December 6, 2000. A grant was awarded on February 15, 2001. T.O.X.I.C., Inc has retained a TAG consultant who has attended some technical project meetings and has reviewed and provided comments on draft documents during the development of the Remedial Investigation/Feasibility Study.

D. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

The selected remedy was developed by combining components of different source control and management of migration alternatives to obtain a comprehensive approach for Site remediation. In summary, the remedy provides:

- Excavation of contaminated soils and sediments above site specific cleanup levels;
- Consolidation of excavated soils, sediments, and debris into the landfill;
- Construction of a multi-layer impermeable cap over the Landfill Lobes;
- Interception of groundwater from the Southern Lobe;
- A combination of collection and treatment and monitored natural attenuation for contaminated groundwater; and
- Institutional controls, long-term operation, maintenance and monitoring.

The remedy addresses potential risks from contaminated soils, surface water, sediments and groundwater .

The principal and low-level threats that this ROD addresses are summarized in the following table:

Principal Threats		
Affected Media	**Contaminant(s)**	**Action To Be Taken**
Waste/Soils in Landfill Lobes	(1)	Source Control (Capping)
Indoor Air (FDDA) – Vapor Intrusion Originating from Groundwater and Soil (3) Contamination	Toluene, Xylenes	Source Removal
Groundwater	Aromatic VOCs, Chlorinated VOCs, Ketones, 1,4-Dioxane, Metals	Active Treatment and MNA
Surface Water (Upper Sutton Brook – Site Channel)	(2)	Source Control
Low Level Threats		
Affected Media	**Contaminant(s)**	**Action To Be Taken**
Upland Soils (GSA)	PAHs	Source Removal
Upland Soils (GSA)	Di-n-octylphthalate, Metals	Source Removal
Upland Soils (FDDA)	Aromatic VOCs, Phthalates, Naphthalene	Source Removal
Sediments (Upper Sutton Brook – Site Channel)	(2)	Source Removal

Notes

(1) Presumptive remedy employed; specific risk-drivers have not been defined
(2) As part of the presumptive remedy, this medium/area has been presumed to have ecological risk, but specific risk-drivers were only assumed based on screening-level evaluation and have therefore not been included in the table. See Section G for further information.
(3) The contribution of soil VOCs to future indoor air impacts was not quantitatively assessed in the risk assessment. However, the residual levels of contaminants in soils may present a principal threat for the vapor intrusion pathway due to their high volatility.

E. SITE CHARACTERISTICS

Section 2.0 of the Feasibility Study (FS) Report contains an overview of the Remedial Investigation. The significant findings of the Remedial Investigation are summarized below.

Refer to the Remedial Investigation (RI) Report for complete details.

1. Conceptual Site Model

The sources of contamination, release mechanisms, exposure pathways to receptors for the Site, as well as other site-specific factors, are diagrammed in a Conceptual Site Model (CSM), which is provided in attached Figure E-1. The CSM is a three-dimensional "picture" of site conditions that illustrates contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors. It documents current and potential future site conditions and shows what is known about human and environmental exposure through contaminant release and migration to potential receptors. The risk assessment and response action for the Site are based on this CSM.

The sources of contamination for the Site are primarily the landfill waste, soils at the Former Garage and Storage Area (GSA), and buried drums at the Former Drum Disposal Area (FDDA).

The primary constituents detected in the groundwater samples near the Landfill Lobes were volatile organic compounds (VOCs) and metals followed by semi-volatile organic compounds (SVOCs) in several wells and one pesticide. The highest concentrations of VOCs were detected in the wells located adjacent to the northwestern and northeastern sides of the Southern Lobe. The VOC generally detected at the highest concentration in the wells was toluene.

Similar constituents as detected in groundwater were also detected in surface water and sediment samples. The samples with the highest concentrations were detected in the stretch of Sutton Brook which traverses in between the two Landfill Lobes.

A removal action was conducted in the FDDA, initially performed by EPA in 2000 and completed by a group of PRPs in 2002, in which approximately 300 to 400 crushed drums were excavated and 13,786 tons of soils were transported off-site for disposal at an approved facility. Post-excavation data indicated that residual levels of VOCs (benzene, TCE, toluene, PCE, ethylbenzene, trimethylbenzenes, and xylenes) and SVOCs (bis(2-ethylhexyl)phthalate, di-n-octylphthalate, and naphthalene) are present in soils. The highest concentrations of VOCs and SVOCs were detected at or just above the water table surface (4 to 6 feet below current grade) and decrease with depth. The highest total VOC and SVOC concentrations were detected in samples located on the southeast portion of the FDDA. Approximately 9,000 cubic yards of residually-impacted soils are estimated to remain in this area.

The primary migration pathways for these residual contaminants are infiltration/leaching into the subsurface with subsequent transport via groundwater flow. In addition, soil erosion and volatile air emissions are potential migration pathways for contaminants that may be exposed or migrate to the surface. However, the highest concentrations of contaminants are not located at the ground surface.

VOCs were also the primary constituents detected in the groundwater samples at the FDDA with benzene, toluene, ethylbenzene, and xylenes (BTEX) and lower concentrations of 1,1,1-TCA, TCE, and 1,1-DCA being detected at the greatest frequency. Elevated concentrations of 4-methyl-2 pentanone, 2-butanone, and phenols were also detected in groundwater proximate to the FDDA.

These data indicate that there are two primary contaminant plumes in groundwater beneath the Site. The sources of these plumes are the FDDA and the Southern Lobe (the Northern Lobe contributes a relatively small amount of groundwater contamination when compared with the FDDA and the Southern Lobe). As contaminants within these plumes migrate away from the source areas, the plumes discharge into the wetland area and Sutton Brook. The results of the surface water and sediment sampling within the brook and wetland areas correlate well with groundwater contamination and groundwater plume discharge areas.

2. Site Overview

The Sutton Brook Disposal Area, also referred to as Rocco's Landfill, is located off South Street on the eastern boundary of the Town of Tewksbury, Middlesex County, Massachusetts. A small portion of the Site also extends into the Town of Wilmington. Key site features and ground surface contours are illustrated on attached Figure E-2. For purposes of presentation and discussion, the Site is divided into the following two major source areas: the Landfill Lobes, referred to as the Northern Lobe and Southern Lobe, and the FDDA. The solid waste source areas comprise about 40 acres of the Site. In 2000, between 300 and 400 buried drums were removed from the FDDA, which is located northwest of the Northern Lobe. Sutton Brook (and associated wetlands) flows east to west through the property, dividing the landfill into the Northern and Southern lobes. Additional wetland areas are located south of the landfill and along the eastern and western portions of the Site.

The majority of the Site is unpaved and relatively flat, aside from the steeply-sloped landfill lobes. Outside the landfill lobes, the Site primarily consists of wetlands including several individual wetland areas (a red maple swamp/floodplain associated with Sutton Brook [greater than 50 acres]; a small man-made pond (approximately 2 acres); man-made areas subject to flooding (small forested wetland area and a borrow pit); and an emergent wetland area).

The overburden geology of the area is characterized by glacial features (e.g., outwash and till deposits). The site-specific unconsolidated materials underlying these surficial deposits consist primarily of sand layers (stratified drift) underlain by a till laid down on top of bedrock. Depth to rock at the Site ranges from 20 to 60 feet below ground surface (ft bgs). The mapped rock, along with the rock cores obtained during the RI, indicate that two types of rock were encountered beneath the Site. A granite or granodiorite, referred to as the Andover Granite, is classified as a light to medium-gray, foliated, medium to coarse grained muscovite-biotite granite. The other rock type, gneiss, is classified as a thinly bedded to massive amphibolite; minor biotite gneiss. A weathered zone was observed at the top of the rock followed by more competent rock with moderate fracturing.

Unlike the ground surface topography (aside from the landfills), the bedrock surface topography varies considerably across the Site. A bedrock outcrop was observed on the westernmost portion of the area adjacent to Sutton Brook. The bedrock surface generally slopes in a southerly to southwesterly direction across the Site. A deep bedrock valley on the southwestern portion of the Site has been filled with glacial drift deposits creating a higher transmissivity water zone (e.g., the Town's former Poplar Street wellfield was located in this valley).

The ground surface across the Site consists of landfill lobes or fill areas, wetland soils, or an upper sand layer. The upper sand layer (10 to 45 feet in thickness) is comprised of a brown to gray medium to fine sand with a little silt and exists across the entire Site. The units underlying this layer are controlled by the depth to bedrock and the presence and thickness of a till layer. In areas of deeper bedrock, coarser sand with some gravel was encountered beneath this upper sand, as seen on the western portion of the Site.

The main hydrologic feature at the Site is Sutton Brook and associated tributaries and wetlands. Sutton Brook is a medium gradient stream that includes both moderately moving water through established banks and slower moving water through much wider and less-established channels. The stream bed is comprised of sand and gravel with some areas of muck and peat. Sutton Brook originates in an upland area north of the Site in Andover and flows southerly, turning westerly to northerly through the Site with discharge to the Shawsheen River approximately 2,500 feet northwest of South Street. As Sutton Brook traverses the Site, the character of the brook is affected by the channel width, the channel depth, the composition of the soils underlying the brook, and tributaries that contribute to the brook.

Based on the majority of the water table elevations, surface water elevations, and stream gauging measurements, EPA has concluded that shallow groundwater generally discharges to Sutton Brook. In contrast, the wetlands area and smaller tributaries experience variable elevations, indicating that they both discharge to and are recharged by shallow groundwater throughout the seasons.

Depth to groundwater at the Site ranges from approximately near/at ground surface to a depth of approximately 12 feet below ground surface. In general, the water table surface (i.e., top of the groundwater surface) mimics the natural land surface topography of the area and is influenced by the streams and wetland areas. Generally, the overall groundwater flow patterns are similar throughout the seasons: north of the Site, groundwater flows southerly towards Sutton Brook or westerly towards the Shawsheen River; groundwater east of the Site flows westerly or southerly towards Sutton Brook and an unnamed tributary; groundwater south of the Site flows northerly towards Sutton Brook or the Shawsheen River; and groundwater west of the Site flows either northerly toward the Shawsheen River or easterly towards Sutton Brook. Groundwater in the intermediate overburden also flows toward Sutton Brook and the Shawsheen River.

Due to the changes in water levels, slight changes in the direction of groundwater flow were observed from the groundwater low measurements (September 2005) to the groundwater high measurements (May 2006), specifically on the northwest portion of the Site near the FDDA and in the wetland area south of Sutton Brook. Still, under both seasons, flow continued towards Sutton Brook and eventually followed the direction of the stream flow of Sutton Brook. The FDDA also exhibited the flattest horizontal gradients at both the water table surface and the intermediate overburden potentiometric surfaces. There were similar, slight localized changes in the groundwater flow patterns on other areas of the Site from season to season. However, overall, groundwater flow at the Site measured over the seasons remains consistent with the regional groundwater flow patterns. (See Attached Figure E-3)

Based on a review of the hydraulic gradients, groundwater flow is in a predominantly horizontal direction (horizontal gradients greater than vertical gradients) with an upward flow component under the majority of conditions. This average upward flow pattern is maintained through the seasonal variations measured at the Site.

3. Remedial Investigation Sampling Strategy

Data collected at the Site and surrounding areas and used in the Remedial Investigation are comprised of both previous Site investigations and the recently completed Phase 1A and Phase 1B Remedial Investigations. These data encompass sampling and investigation activities performed from 1989 to 2006 (together referred to as the RI).

The recent RI field activities (i.e., 2004 and 2006) consisted of activities related to the following tasks:

- Site Survey (elevation and location surveys of investigation points)
- Soils and Sources of Contaminants Investigation (soil borings, surficial soil sampling, and test pit excavations)
- Subsurface and Hydrogeological Investigation (installation of temporary and permanent monitoring wells, groundwater sampling, stream piezometer installation, water level measurements, stream gauging, in situ hydraulic conductivity testing, and groundwater modeling)
- Air Quality Assessment (landfill gas sampling)
- Surface Water and Sediment Investigation (surface water, wetland soil/sediment, and sediment sampling)
- Ecological Assessment (wetland delineation, floodplain delineation, and habitat characterization)

Samples were analyzed by the off-site laboratory for VOCs, SVOCs, metals, PCBs, pesticides, and general chemistry parameters. A summary of the combined data set developed as part of this RI, which includes previous data deemed "usable" through the data review process and the recently collected data, is provided in the table below.

Summary of RI Locations

Sample Media	Total Number of Locations - Previous Investigations	Total Number of Locations - Phase 1A RI, 1B RI, and pre-ROD (2004 – 2006)	Total Number of Locations
Test Pit Explorations	10	38	48
Soil Samples (Surface, Wetland, and Sub-Surface)	55	41	96
Monitoring Wells, including Temporary Wells and Piezometers	64	46	110
Groundwater Sampling Events[1]	4	8	12
Landfill Gas	3	8	11
Sediments	27	45	72
Surface Water	16	28	44
Ambient Air	7	0	7
Leachate	0	2	2

Notes: [1] Not all monitoring wells were sampled during each sampling event.

Following analysis, data usability was assessed by reviewing laboratory data for each medium and assessing whether they met the prescribed project quality objectives (PQOs) developed in the Quality Assurance Project Plan (QAPP). These data were reviewed in terms of their precision, accuracy, representativeness, completeness, and comparability (PARCC). The historic data deemed "usable" (see above) were determined to be generally consistent with QAPP requirements and suitable for use in the RI.

Based on the results of the data quality assessment, data collected during the RI are considered to be suitable for their intended use in satisfying the RI objectives. These objectives (or end uses) include evaluating the contaminant sources; determining the nature, extent, and distribution of contaminants; and assessing the current and future potential risks to human health and the environment.

4. Nature and Extent of Contamination

For discussion purposes, the nature and extent of contaminants at the Site have been divided into the following areas:

- Source Areas
    - Landfill Lobes

  - o Former Drum Disposal Area
  - o Garage, and Storage Area

- Non-Source Areas – wetlands, brook and downgradient groundwater

A summary of the principal RI findings for each of these source areas is presented in the following sections.

Landfill Lobes

Of the two Landfill Lobes, the Northern Lobe is the largest at approximately 30 acres (estimated 1.9 million cubic yards of material) whereas the Southern Lobe comprises approximately 10 acres (estimated 0.3 million cubic yards of material). Small debris/waste piles have also been identified in five distinct areas near the Landfill Lobes. The Landfill Lobes constitute the primary source areas at the Site. A depiction of the Landfill Lobes is presented on Attached Figure E-4.

The primary migration pathways for contaminants from the Landfill Lobes are:

- infiltration/leaching of contaminants from the waste into the subsurface with subsequent transport via groundwater flow;
- soil erosion and wind blown transport of contaminants that are exposed at the surface, including both dust and surface water runoff; and
- volatile air emissions and transport.

Landfill gases generated from the two lobes ranged from 14 to 70% methane; 15 to 34% carbon dioxide; and 0.7 to 540 ppm total VOCs. The VOCs detected at the greatest frequency in the landfill gas samples were toluene, xylene, ethylbenzene, n-hexane, and dichlorofluoromethane.

Based on the RI data (visual observations of the slopes; groundwater samples proximate to the lobes; surface water and sediment samples; and landfill gas and ambient air samples), groundwater migration is the primary contaminant migration pathway associated with the lobes for the following reasons: 1) the uncapped/uncontained nature of the landfill does not limit infiltration and subsequent leaching; 2) wastes are most likely located at or near the water table surface; 3) the presence of VOCs in Sutton Brook in-between the Landfill Lobes; 4) typical landfill gas levels in the subsurface and low to non-detect concentrations of VOCs in ambient air indicating minimal mass transport; and 5) the majority of the material in the lobes is covered on the ground surface with soils and/or vegetation, thereby reducing transport by runoff.

The primary constituents detected in groundwater samples were VOCs and metals. The highest concentrations of VOCs were detected in the groundwater collected from monitoring wells located adjacent to the northern sides of the Southern Lobe. Total VOC concentrations in these wells ranged from 3,450 to 57,210 ug/l (2004 data). The VOC generally detected at the highest concentration in the wells was toluene. Groundwater data from the wells along the perimeter of the Northern Lobe were much lower in concentration (total VOCs ranged from 53 to 842 ug/l – 2004 data). Unlike the Southern Lobe, the VOC generally detected at the highest concentration in the wells near the Northern Lobe was either 1,4-dioxane or tetrahydrofuran. Based on information collected during the RI, the Southern Lobe appears to be the primary contributor to the elevated concentrations of volatile organics in groundwater and in Sutton Brook sediments.

The overall distribution of total VOCs in groundwater supports groundwater flow in the direction of Sutton Brook. Similar constituents to those detected in groundwater were also detected in leachate samples and in surface water and sediment samples. Surface water and sediment samples with the highest concentrations were detected in the stretch of Sutton Brook between the two lobes. A depiction of this area along with the approximate limits of solid waste is depicted on attached Figure E-4.

Former Drum Disposal Area

A removal action was conducted in this area, initially performed by EPA in 2000 and completed by a group of PRPs in 2002, in which approximately 300 to 400 crushed drums were excavated and 13,786 tons of soils was transported off-site for disposal (as non-hazardous waste). Post-excavation data indicate that residual levels of VOCs (TCE, toluene, PCE, ethylbenzene, trimethylbenzenes, and xylenes) are present in soils, with toluene, ethylbenzene, and xylenes exhibiting the highest concentrations and greatest frequency of detection. The highest total VOC concentrations were detected in samples located on the southeast portion of the FDDA. This area (southeast portion) also corresponds to an area of elevated SVOCs, specifically bis(2-ethylhexyl)phthalate, di-n-octylphthalate, and naphthalene, and the area where more of the drums were formerly located. A depiction of the impacted soil area is presented on attached Figure E-5.

Similar to the contamination in soils, VOCs were the primary constituents detected in the groundwater samples at the FDDA, with benzene, toluene, ethylbenzene and xylenes, and lower concentrations of 1,1,1-TCA, TCE, and 1,1-DCA being detected at the greatest frequency. Elevated concentrations of 4-methyl-2 pentanone, 2-butanone, and phenols were also detected in groundwater proximate to the FDDA.

The dissolved VOC concentrations in groundwater were found to decrease with distance from the FDDA. The highest concentrations of VOCs are located at an intermediate depth within the overburden aquifer and within a low hydraulic conductivity medium to fine sand layer. The groundwater data also indicate that impacts are limited to the overburden and that contaminants have not migrated into the bedrock aquifer.

As the groundwater plume approaches Sutton Brook, the groundwater flow patterns and the presence of conditions supporting natural degradation appear to be the controlling factors to the nature and extent of the groundwater contamination in this area. Local groundwater (to the immediate sides of the brook and in the wetland areas) flows east or west, respectively, towards the brook and wetlands. There is also a net northerly component of flow (regional flow path) that parallels the flow of the brook. The horizontal hydraulic gradients are relatively flat, especially in the intermediate overburden (area of higher groundwater contamination) as groundwater approaches the wetlands/brook. These low gradients and low hydraulic conductivity result in a reduced groundwater velocity and reduced subsequent contaminant migration rates.

Historical contaminant analytical data and the existing subsurface geochemistry indicate that a combination of natural attenuation processes (biodegradation, dispersion, dilution, adsorption, volatilization, and/or chemical or biological stabilization, transformation, or destruction of contaminants) are reducing contaminant concentrations and preventing continued downgradient migration. The combination of hydrological conditions and natural degradation factors has resulted in a stable plume configuration, and the contaminated plume is not expected to migrate beyond its current configuration. Refer to the February 2007 RI Report and information presented later in this section for further discussion on natural attenuation at the Site.

Garage and Storage Area

This area is located on the northwest portion of the Site and consists of the former residence, garage, and storage areas (see attached Figure E-6). The majority of the area contains surficial debris from past and current storage activities. Impacted soils (petroleum hydrocarbons, PAHs, and metals) are present on the south central portion of the area and most likely were caused by storage or operation activities in this area. A subsurface fill area, comprised of wood, metal, and concrete, is present on the southern portion of the area. Groundwater is not impacted from operations within this area.

Non-Source Areas

The "non-source" areas primarily consist of the wetlands in areas away from the source areas (i.e., hydraulically downgradient areas, upstream areas of Sutton Brook, and the nearby tributaries). These areas and samples collected within these areas are shown on attached Figure E-7.

The non-source areas also include the area of groundwater located hydraulically downgradient of the "source areas" with organic constituents detected in excess of Federal drinking water maximum contaminant levels (MCLs) (see attached Figure E-8). A combination of natural attenuation processes (biodegradation, dispersion, dilution, adsorption, volatilization, and/or chemical or biological stabilization, transformation, or destruction of contaminants) and hydrogeological conditions are reducing contaminant concentrations in this "downgradient" area, reducing the overall contaminant mass, and preventing contaminant migration beyond the current configuration of the plume. This conclusion was based on the decreasing and/or stabilizing groundwater plume, the presence of breakdown products, the reducing levels of electron acceptors, and the increasing levels of metabolic by-products (i.e., ferrous iron and methane) across the Site. Refer to the February 2007 RI Report and information presented later in this section for further discussion on natural attenuation at the Site.

In contrast, unlike the dissolved VOC plumes, arsenic concentrations in groundwater in excess of MCLs are detected in wells on the Site and upgradient wells, suggesting that arsenic concentrations may be naturally-occurring at "elevated" levels. Arsenic is a common contaminant of concern at many landfills and the precise origin of the arsenic in groundwater is often difficult to determine. A review of the analytical data indicates that arsenic levels have remained fairly consistent over time with a slight upward pattern in select areas.

Higher concentrations of arsenic are found in areas adjacent to or immediately downgradient of the Site source areas (landfill and FDDA). This condition appears to be related to the subsurface environment and resulting geochemical processes caused by these source areas (e.g., reducing conditions causing increased arsenic concentrations). As oxidizing conditions return to the subsurface at locations away from these areas, the arsenic concentration in groundwater decreases.

These conditions demonstrate that although some mass of arsenic may be a result of deposition into the source areas, the resulting geochemistry within the subsurface has likely played a significant role in the elevated arsenic levels immediately downgradient of the source areas. Further discussion of arsenic in groundwater at this Site is provided in the February 2007 RI Report.

5. Contaminant Fate & Transport

The following text provides insight as to the fate and transport of contaminants at the Sutton Brook Disposal Area Site. For potential human and ecological exposure pathways, refer to the Conceptual Site Model (Figure E-1).

Plume Characterization and Migration Pathways – VOCs

A depiction of the approximate areal extent of the primary constituents detected in groundwater was presented in attached Figures E-9 through E-12. These figures depict the Southern Lobe and the FDDA as the primary source areas for the VOC contaminant plumes. The purgeable aromatic hydrocarbons and tetrahydrofuran plumes are similar in configuration, whereas the 1,4-dioxane plume is more widespread, detected at lesser concentrations, and suggests source contribution from both landfill lobes. These findings may be attributable to 1,4-dioxane being more soluble and less degradable than the aromatic hydrocarbons.

The predominant factors that ultimately control the migration pathways of the contaminant plumes include the hydrogeologic environment, the location and characteristics of the source areas, and the partitioning/migration characteristics of the specific contaminants comprising the plume. Based on the previous discussion on source characterization, fate and transport characteristics of the predominant contaminants, and the site-specific hydrogeologic environment, the processes of advection, dispersion, and natural degradation/attenuation are most likely the primary characteristics controlling the migration of the dissolved VOC plumes in groundwater. Figures E-9 through E-12 also show that the plumes are generally contained within the immediate boundaries of the Site (i.e., plume configurations are controlled by groundwater flow, discharge to the brook and associated wetlands, and degradation/attenuation mechanisms).

As groundwater flows through the source areas, VOCs partition into the groundwater and flow with groundwater away from the source areas, forming a dissolved VOC plume. The predominant mechanism for migration of the plume away from the source area is through advection (which refers to transport in a fluid, groundwater, in this case). In the area of the Southern Lobe, it appears that groundwater (based on potentiometric head data) and the dissolved VOCs (based on concentrations detected in monitoring wells) migrate away from the source area in a predominantly northeasterly to northerly direction. In the area of the FDDA, the dissolved VOCs migrate in a southwesterly to westerly direction towards Sutton Brook and the associated wetlands.

Once both plumes reach the general vicinity of the brook and wetlands, the plumes merge with regional groundwater flow and travel in a predominantly northerly direction. Based on hydraulic gradients, the dissolved VOC plume predominantly migrates in the horizontal direction with a slight upward component of flow as the plume approaches the brook and wetlands.

To aid in estimating the rate of contaminant movement, the numerical groundwater model MODFLOW was used to simulate hydrogeologic conditions and the movement of groundwater in the vicinity of the Site. Given that advection is the primary transport mechanism for the dissolved VOC plume, the model was a useful tool to aid in the understanding of potential contaminant migration pathways. The results of the model-simulated groundwater flow directions were generally consistent with groundwater flow directions configured from the groundwater level measurements. Based on the particle tracking analysis performed as part of the model calibration, the simulated discharge locations for particles placed in the source areas were consistent with actual mapped contaminant locations.

The higher VOC concentrations are detected in the intermediate overburden. Hydraulic gradients in this zone of the aquifer are relatively flat (0.001 ft/ft range) and, when combined with low conductivity, result in a reduced groundwater velocity and subsequent reduced contamination migration rates. As such, contaminant dissolution, flushing, and dispersion processes are expected to occur fairly slowly.

The groundwater data also indicate that contamination is limited to the overburden and has not migrated into the bedrock aquifer. The bedrock wells installed downgradient of the source areas (MW-7R, MW-8R, MW-22R, and MW-17B) were either non-detect for VOCs or detected low concentrations (less than 2 ug/l). Several of these wells are located within the bedrock low or "trough" downgradient of the source areas. Based on the location of these wells and the low concentrations of VOCs detected, it is not likely that a non-aqueous phase would be present in bedrock in this low area.

In summary, both the potentiometric surveys and the groundwater model confirm that dissolved

VOCs and SVOCs (including purgeable aromatics, chlorinated compounds, and ketones, among others) migrate away from the two main source areas and toward Sutton Brook and the wetland areas surrounding Sutton Brook. Once at the brook and in the area of the wetlands surrounding the brook (downgradient from both source areas), regional groundwater controls the flow regime with groundwater following the brook, in a predominantly northerly flow direction.

Though the dissolved VOC plume predominantly migrates in the horizontal direction, hydraulic data collected at the Site show that there is also a slight upward component of flow as the plume approaches the brook/wetlands. Along with the low hydraulic conductivity and reduced groundwater velocity estimated in the intermediate overburden, the upward component of flow may also have an impact on contaminant transport at the Site since the potential for off-site groundwater transport is further reduced. Because the upward component of flow will tend to limit contaminant migration to bedrock, groundwater will be more likely discharge to surface water.

Natural Attenuation Processes

Analytical and geochemical data have indicated that natural attenuation processes are occurring within and downgradient of the source areas. These natural in-situ attenuation processes include biodegradation, dispersion, dilution, adsorption, volatilization, and chemical or biological stabilization, transformation, or destruction of contaminants. In addition, chemical footprint indicators, including the absence of electron acceptors oxygen, nitrate, and sulfate and the presence (and subsequent increase spatially on-site) of metabolic by-products methane and ferrous iron have been measured within and immediately downgradient of source areas on-site, indicating that biodegradation processes are interacting with contaminants in groundwater.

Contaminant Trend

No significant increasing trends in concentrations of dissolved VOCs or significant changes in the shape of the dissolved VOC plumes have been detected at the Site throughout the sampling events. Although a significant amount of new groundwater data have been recently collected, the extent and concentration distribution of the plume on the Site appears to be generally consistent throughout the past twelve years of sampling (dating back to 1995).

6. Principal and Low-Level Threats

Principal threat wastes are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. The manner in which principal threats are addressed generally will determine whether the statutory preference for treatment as a principal element is satisfied. Wastes generally considered to be principal threats are liquid, mobile, and/or highly-toxic source material.

Low-level threat wastes are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure. Wastes generally considered to be low-level threat wastes include non-mobile contaminated source material of low-to-moderate toxicity, surface soils containing chemicals of concern that are relatively immobile in air or groundwater, low leachability contaminants, or low toxicity source material.

The principal and low-level threats that this ROD addresses are summarized in the following table:

Table E-1
Principal and Low-Level Threats

Principal Threats				
Affected Media	**Contaminant(s)**	**Reason(s)**	**Concentration(s)**	**Receptors**
Waste/Soils in Landfill Lobes	(1)	(1)	(1)	Human/ Ecological
Indoor Air (FDDA) – Vapor Intrusion Originating from Groundwater and Soil (3) Contamination	Toluene, Xylenes	High Volatility	78 mg/L (Toluene), 28 mg/L (Xylenes)	Future Resident; Future Facility Worker
Groundwater	Aromatic VOCs, Chlorinated VOCs, Ketones, 1,4-Dioxane, Metals	High Mobility or High Toxicity	115 mg/L (BTEX), 6.3 mg/L (Chlorinated VOCs), 340 mg/L (Ketones), 3 mg/L (1,4-Dioxane), 2.3 mg/L (Arsenic)	Future Resident; Future Facility Worker
Surface Water (Upper Sutton Brook – Site Channel)	(2)	(2)	(2)	Fish and Invertebrate Communities
Low Level Threats				
Affected Media	**Contaminant(s)**	**Reason(s)**	**Concentration(s)**	**Receptors**
Upland Soils (GSA)	PAHs	Low Volatility and Leachability	130 mg/kg (Total PAHs)	Future Resident
Upland Soils (GSA)	Di-n-octylphthalate, Metals	Low Toxicity Non-mobile	233 mg/kg (Lead), 379 mg/kg (Zinc)	Carnivorous Wildlife; Invertebrates
Upland Soils (FDDA)	Aromatic VOCs, Phthalates, Naphthalene	Low Toxicity	46 mg/kg (Aromatic VOCs), 159 mg/kg (Phthalates), 1.4 mg/kg (Naphthalene)	Carnivorous Wildlife; Plants; Invertebrates
Sediments (Upper Sutton Brook – Site Channel)	(2)	(2)	(2)	Benthic Invertebrates

Notes

(1) Presumptive remedy employed; specific risk-drivers have not been defined
(2) As part of the presumptive remedy, this medium/area has been presumed to have ecological risk; risk-drivers were identified based on screening-level. See Section G for further information.
(3) The contribution of soil VOCs to future indoor air impacts was not quantitatively assessed in the risk assessment. However, the residual levels of contaminants in soils may present a principal threat for the vapor intrusion pathway due to their high volatility.

F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

1. Land Uses

The Sutton Brook Disposal Area Site is essentially undeveloped and surrounded primarily by open space, farming operations, a composting operation, and residential dwellings. An unoccupied residential home (the former Rocco residence) is situated on the northwest corner of the Site. The nearest occupied residences abut the Site boundary and are located on South Street to the northwest, Bemis Circle and Serenity Drive to the west, and Carlton Road Extension and Homestead Lane to the south. Freshwater wetlands are located south of the landfill and along the eastern and western portions of the Site. The area within one-half mile of the Site is primarily used for residential, light commercial/industrial, and agricultural purposes with areas of protected open space present for recreational use.

As a practical matter, residential or other uses that require the construction of buildings and other significant structures within the landfill lobes would be limited due to institutional controls that will be placed to protect the remedy. Future recreational use of the wetland areas adjacent to the landfill lobes would be compatible with Site controls and surrounding land uses. For the upland areas adjacent to the landfill (the former drum disposal area and former residence, garage and storage area), future reuse options may include both residential and commercial/industrial development, possibly with family and/or group daycare centers.

A reuse assessment was performed for the Site in 2002. In part, development of the reuse assessment involved interviews with town representatives and residents. Ideas relating to site reuse ranged from a passive open conservation area to active recreational use such as athletic fields, a golf course, driving range, or outdoor amphitheater. Tewksbury residents and local organizations have also expressed a need for athletic fields. Based on the information provided by the community representatives, residents favor reusing the Site as some form of open space, possibly with recreational trails.

Reasonably anticipated future uses of the Site include passive recreational use of the wetland areas and residential/commercial use of the upland areas, beyond the landfill lobes. Reasonably-anticipated future uses of adjacent land in surrounding areas include recreational and residential/commercial use.

The ultimate development of parcels adjacent to the Site has the potential to influence the nature of the future ecological or recreational reuse on the Site itself. One particularly important parcel is the Perkins Development Trust property, located northeast of the Site, across the abandoned Boston and Maine railroad grade (see Figure E-2). This property has been the subject of a number of development proposals, most recently a large shopping mall. It is possible that a new exit may be built off of I-93 to serve the development as well as other nearby properties in Wilmington and Andover.

2. Groundwater/Surface Water Uses

Within the vicinity of the Site are mapped medium and high yield potentially productive aquifers and approved Zone 2 water supply areas. Several private wells are located in the nearby residential areas. The Town of Tewksbury currently relies on the Merrimack River as its source of drinking water (though not all residences are connected to the Town's system). However, the Town has five inactive public water supply wells located southwest of the Site which were abandoned in place around the mid 1990's (not due to impact from the Site).

Mass DEP completed a Groundwater Use and Value Determination for the Site in 1991 (Appendix B). The Department's recommendation supports a "medium" use and value, as the aquifer under the Site is considered a medium yield aquifer and it is considered a potential drinking water source. The potential beneficial use of the groundwater at the Site and surrounding areas is use of the aquifer as a drinking water supply. There is no schedule currently in place for this aquifer to be used as a drinking water supply.

The current and potential future use of the surface water at the Site and surrounding areas is passive recreation. As no fish were found during fish surveys within Sutton Brook, fishing is not considered as a potential future use.

G. SUMMARY OF SITE RISKS

A baseline risk assessment was performed to estimate the probability and magnitude of potential adverse human health and environmental effects from exposure to contaminants associated with the Site assuming no remedial action was taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. The baseline risk assessment followed a four step process: 1) hazard identification, which identified those hazardous substances which, given the specifics of the Site were of significant concern; 2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure; 3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances, and 4) risk characterization and uncertainty analysis, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic risks and a discussion of the uncertainty in the risk estimates. A summary of those aspects of the human health risk assessment which support the need for remedial action is discussed below, followed by a summary of the environmental risk assessment.

1. Human Health Risk Assessment

A baseline human health risk assessment (HHRA) was completed for the Sutton Brook Disposal Area Site to evaluate the likelihood and magnitude of potential human health effects associated with the Site. Due to different property uses, activities, and/or nature and extent of contamination, the Site was divided into the following seven Groups (areas):

- Groups 1 and 2 – Northern and Southern Landfill Lobes, respectively
- Group 3 – Former Drum Disposal Area and Adjacent Disturbed Area
- Group 4 – Former Residence, Garage and Storage Area
- Group 5 – Sutton Brook and Associated Tributary and Wetland Areas
- Group 6 – Area South of Southern Lobe
- Group 7 – Reference Locations

Consistent with EPA's Guidance on Presumptive Remedy for CERCLA Municipal Landfill Sites, direct exposures at the Northern and Southern Landfill Lobes (Groups 1 and 2) were not evaluated in the HHRA due to the presumption that the two Landfill Lobes will be closed in-place using current landfill capping technology. The HHRA evaluated the potential for unacceptable risks to human receptors from exposure to contaminants in: ambient air emanating from the landfill; upland soils at the former drum disposal area (FDDA; Group 3) and former garage and storage area (GSA; Group 4); surface water, sediments, and wetland soils in Sutton Brook and its associated wetlands (Group 5); sediments and surface water in the man-made pond located south of the Southern landfill lobe (Group 6); groundwater beneath the Landfill Lobes (Groups 1 and 2) and beyond the Landfill Lobes (Groups 3-6); and indoor and outdoor air impacted via subsurface migration of volatile compounds at the FDDA and GSA.

Section 1: Identification of Chemicals of Concern

Eighty-six of the more than 100 chemicals detected at the Site were selected for evaluation in the human health risk assessment as chemicals of potential concern. The chemicals of potential concern were selected to represent potential site-related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment and can be found in Tables 3-1 through 3-14 of the risk assessment (RI/FS Volume III, Woodard & Curran, 2007). From this, a subset of the chemicals were identified in the FS as presenting a significant current or future risk and are referred to as the chemicals of concern (COCs) in this ROD. The COCs are identified in attached Tables G-1 through G-4 for upland soils, indoor air, and groundwater beneath (Groups 1 and 2) and beyond (Groups 3-6) the landfill lobes. These tables contain the exposure point concentrations used to evaluate the reasonable maximum exposure (RME) scenario in the baseline risk assessment for the chemicals of concern. Estimates of average or central tendency exposure concentrations for the chemicals of concern and all chemicals of potential concern can be found in Tables 3-23 through 3-30 of the baseline human health risk assessment.

Section 2: Exposure Assessment

Current and potential future site-specific pathways of exposure to chemicals of concern were determined. The extent, frequency, and duration of current or future potential exposures were estimated for each pathway. From these, exposure parameters, a daily intake level for each site-related chemical, was estimated.

The Site is currently undeveloped and surrounded primarily by open space, farming operations, a composting operation, and residential dwellings. Access to the Site is unrestricted, and there are no currently occupied buildings present. The nearest occupied residences abut the Site boundary and are located on South Street to the northwest, Bemis Circle and Serenity Drive to the west, and Carlton Road Extension and Homestead Lane to the south. Sutton Brook flows from east to west through the Site. Freshwater wetlands are located south of the landfill and along the eastern and western portions of the Site. Within the vicinity of the Site are mapped medium and high yield potentially productive aquifers and approved Zone 2 water supply areas. Several private wells are located in the nearby residential areas. The Town of Tewksbury currently relies on the Merrimack River as its source of drinking water. However, the Town has five inactive public water supply wells located southwest of the Site which were abandoned in place around the mid 1990's.

The following is a brief summary of the exposure pathways that were found to present an unacceptable risk at the Site. A more thorough description of all exposure pathways evaluated in the risk assessment including estimates for an average exposure scenario, can be found in Section 3.2 and on Tables 3-16 through 3-21 of the baseline human health risk assessment.

No current exposure pathways were found to present a significant risk at the Site.

The following future exposure pathways were found to present a potential risk exceeding EPA's cancer risk range and non-cancer hazard index at the Site:

- Future exposure of a resident (adult and young child) to upland soils (by ingestion and dermal contact) at the former residence, garage, and storage area;[1]
- Future exposure of a resident (adult and young child) to indoor air (by inhalation) at the former drum disposal area;[2]
- Future exposure of a resident (adult and young child) to untreated groundwater (by ingestion, dermal contact, and inhalation) from Groups 1 and 2 and Groups 3-6 monitoring wells;[3] and
- Future exposure of a facility worker to untreated groundwater (by ingestion and dermal contact) from Groups 3-6 monitoring wells.[4]

[1] For future residential upland soil exposures, exposure durations of 24 years and 6 years, respectively, were presumed for an adult and young child. Body weights of 70 kg and 15 kg were used for the adult and child, respectively. Dermal contact was assumed with 5,700 cm^2 of surface area for the adult and 2,800 cm^2 for the child. Future upland soil exposures were assumed to occur 150 days/year.

[2] For future residential indoor air exposures, exposure durations of 24 years and 6 years, respectively, were presumed for an adult and young child. Future indoor air exposures were assumed to occur 24 hours/day for 350 days/year.

[3] For future residential exposures to untreated groundwater, drinking water ingestion rates of 1.98 L/day and 1.3 L/day for the adult and young child, respectively, were assumed. An exposure frequency of 350 days/year was used for a combined exposure duration of 30 years. Dermal contact was assumed with 18,000 cm^2 of surface area for the adult, and 6,600 cm^2 for the child. Showers/baths were assumed to occur 350 days/year for 0.58 hr/day for the adult and 1 hr/day for the child. Airborne concentrations of volatile compounds released during showering/bathing were estimated using the Foster and Chrostowski shower model.

[4] For future facility worker exposures to untreated groundwater, a drinking water ingestion rate of 1.15 L/day was assumed. An

Section 3: Toxicity Assessment

In the Human Health Risk Assessment, EPA assessed the potential for cancer risks and non-cancer health effects of COCs at the Site.

The potential for carcinogenic effects is evaluated with chemical-specific cancer slope factors (CSFs) and inhalation unit risk values. A weight of evidence classification is available for each chemical. CSFs have been developed by EPA from epidemiological or animal studies to reflect a conservative "upper bound" of the risk posed by potentially carcinogenic compounds. That is, the true risk calculated using the CSF is unlikely to be greater than the risk predicted. A summary of the cancer toxicity data relevant to the chemicals of concern is presented in Table G-5.

The potential for non-cancer health effects is quantified by reference dose (RfD) for oral exposure and reference concentrations (RfCs) for inhalation exposures. RfDs and RfCs have been developed by EPA and they represent an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure that is likely to be without an appreciable risk of deleterious health effects during a lifetime. RfDs and RfCs are derived from epidemiological or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. A summary of the non-carcinogenic toxicity data relevant to the chemicals of concern at the Site is presented in Table G-6.

Section 4: Risk Characterization

Risk characterization combines estimates of exposure with toxicity data to estimate potential health effects that might occur if no actions were taken.

Excess lifetime cancer risks were determined for each exposure pathway by multiplying the daily intake levels (see *Section 2: Exposure Assessment*) by the Cancer Slope Factor (CSF) or by comparison to the unit risk value. These toxicity values are conservative upper bound estimates, approximating a 95% upper confidence limit, of the increased cancer risk from a lifetime exposure to a chemical. Therefore, the true risks are unlikely to be greater than the risks predicted. Cancer risk estimates are expressed as a probability, e.g., one in a million. Scientific notation is used to express probability. One in a million risk (1 in 1,000,000) is indicated by 1×10^{-6} or 1E-06. In this example, an individual is not likely to have greater than a one in a million chance of developing cancer over a lifetime as a result of exposure to the concentrations of chemicals at a site. All risks estimated represent an "excess lifetime cancer risk" in additional to the background cancer risk experienced by all individuals over a lifetime. The chance of an

exposure frequency of 250 days/year was used with an exposure duration of 25 years. Dermal contact was assumed with 2,077 cm^2 of surface area. Dermal contact with groundwater was assumed to occur 250 days/year for 0.01 hr/event with 16 events/day presumed.

individual developing cancer from all other (non-site related) causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site related exposure is 10^{-4} to 10^{-6}. Current EPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances.

In assessing the potential for adverse effects other than cancer, a hazard quotient (HQ) is calculated by dividing the daily intake by the RfD or RfC. A HQ ≤ 1 indicates that an exposed individual's dose of a single contaminant is less than the RfD or RfC and that a toxic effect is unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect the same target organ (e.g., liver) within or across those media to which the same individual may reasonably be exposed. A HI ≤ 1 indicates that toxic non-carcinogenic effects are unlikely.

The following is a summary of the media and exposure pathways that were found to present a risk exceeding EPA's cancer risk range and non-cancer hazard index at the Site. Only those exposure pathways deemed relevant to Site conditions are presented in this ROD. Readers are referred to Section 3.4 and Tables 3-32 through 3-39 of the baseline human health risk assessment for a more comprehensive risk summary of all exposure pathways evaluated for all chemicals of potential concern and for estimates of the central tendency risk.

<u>Resident at the Former Garage and Storage Area</u>

Table G-7 depicts the carcinogenic risk summary for the chemicals of concern in upland soils evaluated to reflect potential future residential exposure corresponding to the RME scenario. For the future young child and adult resident, carcinogenic risk exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6}. The exceedance was due primarily to the presence of carcinogenic polycyclic aromatic hydrocarbons (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) in upland soils.

<u>Resident at the Former Drum Disposal Area</u>

Table G-8 depicts the non-carcinogenic risk summary for the chemicals of concern in indoor air evaluated to reflect potential future residential exposure corresponding to the RME scenario. For the future young child and adult resident, non-carcinogenic risk exceeded the EPA acceptable target organ HI of 1. The exceedance was due primarily to the presence of toluene and xylenes in groundwater with the potential to impact indoor air via the subsurface vapor intrusion pathway. The contribution of soil VOCs to the indoor air pathway was not quantitatively evaluated in the risk assessment. However, based on the residual levels of VOCs in soils at the FDDA, their presence may contribute to potential future indoor air impacts.

Residential Groundwater Use

Tables G-9 through G-12 depict the carcinogenic and non-carcinogenic risk summary for the chemicals of concern in future residential wells evaluated to reflect potential future potable water exposure corresponding to the RME scenario, under the assumption that on-site groundwater from beneath the Landfill Lobes (Groups 1 and 2) and beyond the Landfill Lobes (Groups 3-6) migrates to potable wells installed on the Site, adjacent to or downgradient of the Site in the future. For the future resident using untreated groundwater as household water, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and/or a target organ HI of 1 for groundwater. The exceedances were due primarily to the presence of 1,4-dioxane, 4-methyl-2-pentanone, benzene, methylene chloride, naphthalene, tetrachloroethene, tetrahydrofuran, toluene, trichloroethene, vinyl chloride, methylphenols, N-nitrosodi-n-butylamine, N-nitrosopyrrolidine, arsenic, cadmium, and manganese in Group 1 and 2 groundwater, and 1,4-dioxane, 1,2-dichloroethane, 4-methyl-2-pentanone, acrylonitrile, benzene, carbon tetrachloride, ethyl methacrylate, ethylbenzene, methylene chloride, tetrahydrofuran, toluene, vinyl chloride, xylenes, bis(2-ethylhexyl)phthalate, antimony, arsenic, beryllium, manganese, and zinc in Groups 3-6 groundwater.

Facility Worker Groundwater Use

Tables G-13 and G-14 depict the carcinogenic and non-carcinogenic risk summary for the chemicals of concern in future commercial wells evaluated to reflect potential future potable water exposure corresponding to the RME scenario, under the assumption that on-site groundwater from beyond the landfill lobes (Groups 3-6) migrates to potable wells installed on the Site, adjacent to or downgradient of the Site in the future. For the future facility worker using untreated groundwater as potable water, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable risk range of 10^{-4} to 10^{-6} and/or a target organ HI of 1 for groundwater. The exceedances were due primarily to the presence of 1,4-dioxane, 4-methyl-2-pentanone, acrylonitrile, vinyl chloride, and arsenic in Groups 3-6 groundwater.

Facility Worker at the Former Drum Disposal Area

Table G-15 depicts the non-carcinogenic risk summary for the chemicals of concern in indoor air evaluated to reflect potential future commercial exposure corresponding to the RME scenario. For the future facility worker, non-carcinogenic risk exceeded the EPA acceptable target organ HI of 1. The exceedance was due primarily to the presence of xylenes in groundwater with the potential to impact indoor air via the subsurface vapor intrusion pathway. The contribution of soil VOCs to the indoor air pathway was not quantitatively evaluated in the risk assessment. However, based on the residual levels of VOCs in soils at the FDDA, their presence may contribute to potential future indoor air impacts.

Section 5: Uncertainties

Trichloroethene is currently being re-evaluated for carcinogenic potency by EPA. The high-end of the range of oral slope factors and unit risk values was used for risk estimation. This approach may have resulted in an overestimate of the risk associated with trichloroethene in groundwater. In addition, toxicity values of surrogate compounds were used for compounds with similar structures lacking toxicity values, resulting in either an underestimate or overestimate of risk. These uncertainties will be periodically reviewed to address changes in and the availability of toxicity values for these compounds.

For the groundwater dermal contact pathway, risk associated with dermal absorption of chlorinated organic compounds may be underestimated. Permeability constants for the chlorinated organic compounds such as 1,2-dichloroethane, tetrachloroethene, trichloroethene, and vinyl chloride tend to be underestimated by the correlation modeling. This uncertainty may result in an underestimation of risk. In addition, because there is greater uncertainty associated with the correlation modeling for some compounds, risk associated with dermal absorption could not be quantified for some contaminants, including Aroclor-1254. This uncertainty may also result in an underestimation of risk. These uncertainties will be periodically reviewed to address changes in the dermal absorption values for these compounds.

Airborne concentrations of volatile compounds for the showering/bathing scenario and for indoor/outdoor air were estimated using accepted EPA exposure models. The use of modeling to estimate airborne concentrations of volatile compounds likely results in an over-estimate of risk since conservative assumptions were employed in the exposure modeling. In addition, the contribution of soil volatile compounds to the vapor intrusion pathway was not quantified. Though this may potentially underestimate the impact of volatile compounds from the subsurface on indoor air, the extent of the bias is likely to be low due to the lower prevalence and concentration of volatile compounds in soils relative to groundwater.

2. Ecological Risk Assessment

A baseline ecological risk assessment (BERA) was completed for the Sutton Brook Disposal Area Site to evaluate the likelihood and magnitude of potential ecological effects associated with historical disposal practices. The BERA evaluated the potential for contaminants to impact ecological receptor populations exposed to: upland soils at and outside the former drum disposal area (FDDA); surface water, sediments, and wetland soils in Sutton Brook and its associated wetlands; and sediments and surface water in the man-made pond located south of the Southern landfill lobe.

Section 1: Identification of Chemicals of Concern

Chemicals of Potential Concern (COPCs) were identified in the Screening Level Ecological Risk

Assessment (SLERA) using effects-based screening involving the comparison of maximum contaminant concentrations to ecological benchmarks for each medium and exposure area, and included all COPCs that would bioaccumulate. The refinement of COPCs in the BERA identified COPCs based on exceedance of no observed-adverse effects level (NOAEL) screening values, resulting in an NOAEL HQs greater than 1.0. Data used to identify COPCs are summarized in Table G-16 (Upper Sutton Brook surface water), Table G-17 (Upper Sutton Brook sediments), Table G-18 (Aquatic Wetland surface water), Table G-19 (Aquatic Wetland sediments), Table G-20 (Wetland Soil), Table G-21 (Site Pond surface water), Table G-22 (Site Pond sediments), and Table G-23 (Upland Soil).

The COPCs identified in Upper Sutton Brook surface water include one pesticide (4,4'-DDT), three volatile organic chemicals (ethylbenzene, xylenes, and toluene), and three dissolved metals (barium, manganese and iron). COPCs identified in Upper Sutton Brook sediments include ten VOCs (1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 4-methyl-2-pentanone, acetone, carbon disulfide, chloroethane, ethylbenzene, naphthalene, toluene, and xylenes), three semi-volatile organic chemicals (2-methylphenol, 3-/4-methylphenol, and benzo(a)pyrene), and three metals (arsenic, iron, and manganese).

The COPCs in the Aquatic Wetland surface water include VOCs (ethylbenzene, toluene, and xylenes) and nine metals (aluminum, arsenic, barium, copper, iron, lead, manganese, nickel and zinc). COPCs identified in the Aquatic Wetland sediments include three VOCs (acetone, chloroethane, and toluene), one SVOC (benzoic acid), and five metals (arsenic, beryllium, iron, mercury, and selenium).

The COPCs in the Wetland soils include one pesticide (aldrin), six SVOCs (benzo(b)fluoranthene, benzoic acid, chrysene, fluoranthene, phenanthrene, and pyrene), and five metals (arsenic, manganese, mercury, selenium, and vanadium).

The COPCs identified in the Site Pond surface water include three dissolved metals (barium, manganese, and zinc). COPCs identified in the Site Pond sediments include two VOCs (acetone and carbon disulfide), and arsenic.

The Upland soils evaluated in the SLERA, included both the former drum disposal area (FDDA), as well as other upland areas of the Site. COPCs identified within the Upland soils include one pesticide (4-4'-DDT), five VOCs (1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, xylenes, and toluene), eight SVOCs (1,2,4-trichlorobenzene, 2,4-dimethylphenol, 4,6-dinitro-o-cresol, bis(2-ethylhexyl)phthalate, di-n-butylphthalate, di-n-octylphthalate, fluoranthene, and naphthalene) and six metals (chromium, copper, lead, mercury, vanadium, and zinc). Among these, the maximum values of eight COPCs were measured in sample SB-3(04) within the FDDA.

Section 2: Exposure Assessment

For purpose of the exposure assessment, the Site was divided into five habitat areas, including Upper Sutton Brook, Aquatic Wetland, Site Pond, Wetland Soil, and Upland Soil (including FDDA). Based on the conceptual site model, complete exposure pathways were identified, sampled, tested, and evaluated in each habitat area separately. Consistent with the site conceptual model, exposure pathways, assessment endpoints, and measurement endpoints are summarized in Table G-24.

The majority of the Site is unpaved and relatively flat, aside for the steeply sloped landfill lobes. Outside the landfill lobes, the Site primarily consists of wetlands, including several individual wetland areas (red maple swamp/floodplain associated with Sutton Brook [greater than 50 acres], small man-made pond [approximately 2 acres], man-made areas subject to flooding [small forested wetland area and a borrow pit], and an emergent wetland area).

The main hydrologic feature at the Site is Sutton Brook and associated tributaries and wetlands. Sutton Brook is a medium gradient stream that includes both moderately moving water through established banks and slower moving water through much wider and less-established channels. Sutton Brook flows east to west through the property and divides the landfill into the Northern and Southern Lobes. Sutton Brook originates in an upland area to the north of the Site and flows off site with discharge to the Shawsheen River approximately 2,500 feet northwest of South Street.

The ground surface across the Site consists of the landfill lobes, fill areas, wetland soils, and an upper sand layer. The upland habitat area of the Site, outside of the landfill lobes, includes the generally disturbed and impacted areas around the former residence/garage, the former drum disposal area and associated work areas near the former entrance to the landfill.

The Site is bounded by a piggery, greenhouses, stables, and a wooded area to the north; a wooded area, composting operation, cattle feedlot, Route 93, and the Boston & Maine railroad line to the east; wetlands, conservation land and open space owned by the Town of Tewksbury, and a number of residences along Carleton Road to the south; and wetlands and a number or residences to the west.

Based on consultation with U.S. Fish and Wildlife Service, there are no federally-listed proposed, threatened or endangered species or critical habitat under the jurisdiction of the USFWS known to occur in the project area. Consultation with Massachusetts Natural Heritage and Endangered Species Program (MNHESP), indicated the potential occurrence of an endangered moth, the New Jersey Tea Inchworm. A butterfly species of Special Concern, the frosted elfin, had been documented as to occur in the vicinity of the Site. However, based on habitat characterization conducted as part of the risk assessment, the MNHESP species of concern are not considered likely to occur at the Site due to the lack of available habitat, including critical host plant species.

Potential receptors in Upper Sutton Brook include aquatic invertebrate and fish populations exposed to COPCs in surface water or sediments. Aquatic invertebrate, amphibian populations, and avian species were the receptors used in the Site Pond and Aquatic Wetland habitat areas. The Wetland Soil habitat area was evaluated using terrestrial plants, soil invertebrates, and small terrestrial mammal (short-tail shrew and eastern cottontail rabbit) receptors. Soils in the FDDA were evaluated for terrestrial plants, soil invertebrates, and carnivorous bird (American robin) receptors. Upland soils (excluding the FDDA) were evaluated for receptors including terrestrial plants and soil invertebrates, and terrestrial wildlife (meadow vole and American robin).

Section 3: Ecological Effects Assessment

The risk to receptors in aquatic type habitat areas (Aquatic Wetland, Upper Sutton Brook, and Site Pond) was evaluated on a screening level by comparing measured concentrations to effects-based NOAEL surface water quality benchmarks, sediment quality benchmarks, and/or on the basis of bioavailability as determined by acid volatile sulfide/simultaneous extracted metals (AVS/SEM) analysis of sediments. The screening-level risk to receptors in terrestrial type habitat areas (Wetland, Upland, and FDDA) was evaluated by comparison of measured soil concentrations to effects-based NOAEL soil benchmarks for terrestrial plants and soil invertebrates, and wildlife toxicity reference values (TRVs) that were derived site-specifically and used in food chain exposure risk models.

The site channel portion of the Brook directly between the landfill lobes was evaluated by comparison of five surface water and sediment samples to effects-based NOAEL benchmarks in the screening-level step. Further assessment of ecological effects of exposure in the site channel portion of the Brook (located between the landfill lobes) was not conducted in the BERA, because of the assumption that a remedy would have to address the high risk of COPCs in the site channel.

Potential baseline risk of the COPCs on receptors in all reaches of the Upper Sutton Brook, with the exception of surface water and sediments in the site channel, were evaluated by effects-based, LOAEL benchmarks. Whole sediment toxicity testing was performed to evaluate the potential toxicity of selected Southern Tributary sediment arsenic concentrations on benthic invertebrate populations. Toxicity testing consisted of 10-day whole sediment toxicity tests using the amphipod *Hyalella azteca* and dipteran aquatic insect *Chironomus tentans*.

Baseline risk to receptors in the Aquatic Wetland and Site Pond habitat areas was evaluated for aquatic invertebrates and amphibians using effects-based LOAEL benchmarks for surface water and sediments and semi-aquatic wildlife using TRVs derived site-specifically in food chain models (Table G-23).

Baseline risk to receptors in the Wetland soil habitat area was evaluated using effects-based, LOAEL benchmarks for terrestrial plants, soil invertebrates, and semi-aquatic wildlife using TRVs derived site-specifically in food chain models (Table G-23).

Baseline risk to receptors in the Upland Soil (excluding FDDA) habitat area was evaluated using effects-based LOAEL benchmarks for terrestrial plants, soil invertebrates, and terrestrial wildlife using TRVs derived site-specifically in food chain models (Table G-23).

Section 4: Risk Characterization

Risks to aquatic, semi-aquatic and terrestrial receptors were determined to be significant in the following habitat areas (Table G-25):

- Upper Sutton Brook - site channel (sediments directly between the landfill lobes): Unacceptable risk to aquatic invertebrates based on exposure to 1,3,5-trimethylbenzene, ethylbenzene, and xylenes, among other contaminants (Table G-25). These risks are based on exceedance of effects-based NOAEL benchmarks in the screening-level ecological risk assessment.
- Upper Sutton Brook - site channel (surface water directly between the landfill lobes): Unacceptable risk to aquatic life (e.g., fish, amphibians, invertebrates) from exposure to 4,4'-DDT, ethylbenzene, toluene, and xylenes. These risks are based on exceedance of effects-based NOAEL surface water benchmarks or relevant water quality standards.
- Upland Soil (FDDA): Unacceptable risk to terrestrial plants from bis(2-ethylhexyl)phthalate, ethylbenzene, naphthalene, and xylenes; unacceptable risks to soil invertebrates from 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, toluene, and xylenes. Unacceptable risk to terrestrial wildlife (American robin) based on food chain model dietary exposure to 1,2,4-trimethylbenzene, bis(2-ethylhexyl)phthalate, di-n-octylphthalate, and xylenes.
- Upland Soil (excluding FDDA): Unacceptable risk to terrestrial wildlife (American robin) based on food chain dietary exposure to di-n-octylphthalate and lead. Unacceptable risk to soil invertebrates from exposure to zinc.

Section 5: Uncertainties

Ecological risk assessments are subject to a variety of uncertainties as the result of both the assumptions used to describe the site conditions, habitats and estimated receptor exposures, plus variability in receptor exposure and toxicological response. As a result, the assessment must estimate or infer the information concerning individuals to reach a conclusion about risk at the population level.

The BERA provided a detailed evaluation of potential sources of uncertainty in the calculation of risk (BERA Table 4-57). These uncertainties include a lack of medium-specific and species-specific benchmarks and toxicity data for some of the COPCs. Extrapolation of toxicity data among species and limited data on the bioavailability of COPCs in each medium are factors that contribute to uncertainty in the use of benchmarks.

Additional uncertainties are associated with dietary modeling because concentrations of the COPCs in wildlife prey tissue was not measured but modeled instead using conservative uptake factors.

The risks identified in the site channel portion of the Upper Sutton Brook and Upland Soil habitat area of the FDDA, were not further evaluated in the BERA due to the presumption of a remedy to address the high risk screening-level. Consequently, the risk characterization for these habitat areas is based on effects-based, NOAEL screening values without additional site-specific effects analysis.

3. Basis for Response Action

The baseline human health and ecological risk assessments revealed that:

- a future resident potentially exposed to compounds of concern in soils via ingestion and dermal contact may present an unacceptable human health risk (exceedance of 10^{-4} cancer risk);
- a future resident or facility worker potentially exposed to compounds of concern in groundwater via inhalation may present an unacceptable human health risk (HI of concern);
- a future resident or facility worker potentially exposed to compounds of concern in groundwater via ingestion may present an unacceptable human health risk(exceedance of 10^{-4} cancer risk and HI of concern); and
- unacceptable ecological risk exists to terrestrial plans and wildlife in Upland Soil, aquatic invertebrates in Upper Sutton Brook sediments and aquatic life in Upper Sutton Brook surface water.

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. Groundwater, soils, surface water, and sediments are to be the focus of the remedial action.

H. REMEDIATION OBJECTIVES

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways, response action objectives (RAOs) were developed to aid in the development and screening of alternatives. These RAOs were developed to mitigate, restore and/or prevent existing and future potential threats to human health and the environment. The RAOs for the remedy for the Sutton Brook Disposal Area are to:

- Prevent direct contact/ingestion of landfill contents for the protection of human and ecological receptors;
- Prevent direct contact and ingestion of residual levels of SVOCs and VOCs in soils in the FDDA and metals and SVOCs in soils in the GSA above applicable human health or ecological based criteria;
- Prevent direct exposure to impacted surface water and sediments in those areas of the wetlands and brook determined by the ecological risk assessment;
- Prevent contaminant migration via surface run-off and erosion through the "source areas" to surface water or sediments in the brook or wetlands for the protection of ecological receptors;
- Control landfill gas;
- For the protection of potential human receptors, reduce contaminant leaching via infiltration through the "source areas" with subsequent migration to groundwater at concentrations in excess of State or Federal Maximum Contaminant Levels (MMCLs or MCLs) and applicable groundwater quality standards. For contaminants where no State or Federal drinking water standard has been established, reduce leaching such that groundwater concentrations will not exceed human health risk-based levels (i.e., greater than the carcinogenic target risk range of 10^{-4} to 10^{-6} or non-carcinogenic target organ Hazard Index of 1);
- For the protection of potential human receptors, prevent exposure to groundwater impacted by site contaminants at concentrations that exceed State or Federal drinking water standards (MMCLs or MCLs). For contaminants where no State or Federal drinking water standard has been established, prevent exposure to concentrations which exceed human health risk-based levels (i.e., greater than the carcinogenic target risk range of 10^{-4} to 10^{-6} or non-carcinogenic target organ Hazard Index of 1). For contaminants that are a concern with respect to vapor intrusion, prevent exposure to indoor air concentrations that are not protective of human health;
- Limit the discharge of impacted groundwater to Sutton Brook to prevent site contaminants in surface water or sediments from exceeding ecological based criteria or unacceptable levels of risk to ecological receptors;

- Prevent migration of contaminants off-site via groundwater or surface water at levels in excess of Federal and/or State standards/criteria or unacceptable levels of risk to human or ecological receptors.

More specifically, the remedy will seek:

- To reduce the potential exposure of a future resident to carcinogenic polycyclic aromatic hydrocarbons (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene) in upland soils via direct contact that may present a human health risk in excess of 10^{-4} cancer risk such that the cancer risk attributable to this medium is within the range of 10^{-4} to 10^{-6} and complies with ARARs

- To reduce the potential exposure of a future resident to toluene and xylenes in groundwater via inhalation that may present a human health risk in excess of HI>1 such that the non-cancer risk attributable to this medium is a HI which does not exceed one and complies with ARARs

- To reduce the potential exposure of a future resident to acrylonitrile, benzene, carbon tetrachloride, ethyl methacrylate, ethylbenzene, methylene chloride, xylenes, 1,2-dichloroethane,1,4-dioxane, 4-methyl-2-pentanone, bis(2-ethylhexyl)phthalate, naphthalene, tetrachloroethene, tetrahydrofuran, toluene, trichloroethene, vinyl chloride, methylphenols, N-nitrosodi-n-butylamine, N-nitrosopyrrolidine, antimony, arsenic, beryllium, cadmium, and manganese and zinc in groundwater via ingestion that may present a human health risk in excess of 10^{-4} cancer risk, or a HI>1 such that the cancer and non-cancer risk attributable to this medium are within the range of 10^{-4} to 10^{-6} and a HI which does not exceed one and complies with ARARs

- To reduce the potential exposure of a future facility worker to 1,4-dioxane, 4-methyl-2-pentanone, acrylonitrile, vinyl chloride, and arsenic in groundwater via ingestion that may present a human health risk in excess of 10^{-4} cancer risk or HI>1 such that the cancer and non-cancer risk attributable to this medium is within the range of 10^{-4} to 10^{-6} and a HI which does not exceed one and complies with ARARs

- To reduce the potential exposure of a future facility worker to xylenes in groundwater via inhalation that may present a human health risk in excess of HI>1 such that the non-cancer risk attributable to this medium is a HI which does not exceed one and complies with ARARs

- To reduce the potential exposure of aquatic invertebrates to 1,3,5-trimethylbenzene, ethylbenzene, and xylenes, among others in sediments directly between the landfill lobes that may present an ecological risk in excess of NOAEL benchmarks such that the ecological risk attributable to this medium complies with ARARs

- To reduce the potential exposure of aquatic life (e.g., fish, amphibians, invertebrates) to 4,4'-

DDT, ethylbenzene, toluene, and xylenes in surface water directly between the landfill lobes that may present an ecological risk in excess of effects-based, NOAEL surface water benchmarks or water quality standards such that the ecological risk attributable to this medium complies with ARARs

- To reduce the potential exposure of terrestrial plants to bis(2-ethylhexyl)phthalate, ethylbenzene, naphthalene, and xylenes; soil invertebrates from 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, ethylbenzene, toluene, and xylenes; and terrestrial wildlife (American robin) based on food chain model dietary exposure to1,2,4-trimethylbenzene, bis(2-ethylhexyl)phthalate, di-n-octylphthalate, and xylenes in soils at the FDDA such that the ecological risk attributable to this medium complies with ARARs

- To reduce the potential exposure of American robin based on food chain dietary exposure to di-n-octylphthalate and lead; and soil invertebrates from exposure to zinc in upland soils (excluding FDDA) such that the ecological risk attributable to this medium complies with ARARs

I. DEVELOPMENT AND SCREENING OF ALTERNATIVES

1. Statutory Requirements/Response Objectives

Under its legal authorities, EPA's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: a requirement that EPA's remedial action, when complete, must comply with all Federal and more stringent State environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked; a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and a preference for remedies in which treatment which permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances is a principal element over remedies not involving such treatment. Response alternatives were developed to be consistent with these Congressional mandates.

2. Technology and Alternative Development and Screening

CERCLA and the National Contingency Plan (NCP) set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of alternatives were developed for the Site.

As described earlier (Sections E. and G.), the Sutton Brook Disposal Area Site is comprised of two major source areas (the Landfill Lobes and the Former Drum Disposal Area), one minor source area (the Garage and Storage Area), and the Downgradient Groundwater Area. The

RI/FS (including the Risk Assessment) studied and evaluated these areas discretely regarding the nature and extent of contamination, as well as with regard to evaluating potential risk. Logically, this led to evaluating and screening technologies, as well as developing, screening and evaluating remedial alternatives, discretely, for each area.

With respect to source control, the RI/FS developed a range of alternatives (for the Former Drum Disposal Area and the Garage and Storage Area) in which treatment that reduces the toxicity, mobility, or volume of the hazardous substances is a principal element. This included an alternative that removes or destroys hazardous substances to the maximum extent feasible, eliminating or minimizing to the degree possible the need for long term management. This range also included: alternatives that treat the principal threats posed by the Site, but vary in the degree of treatment employed and the quantities and characteristics of the treatment residuals and untreated waste that must be managed; alternative(s) that involve little or no treatment but provide protection through engineering or institutional controls; and a no action alternative. Consistent with EPA's Guidance on Presumptive Remedy for CERCLA Municipal Landfill Sites, alternatives in which treatment is a principal element were not developed for the Landfill Lobes area because it was assumed that the Landfill Lobes would be capped.

With respect to ground water, the RI/FS developed a limited number of remedial alternatives (for the Landfill Lobes, the Former Drum Disposal Area and the Downgradient Groundwater Area) that attain site specific remediation levels within different time frames using different technologies, and a no action alternative. The Garage and Storage Area is not considered a source of groundwater contamination.

As discussed in Section 4 of the FS, soil and groundwater treatment technology options were identified, assessed and screened based on implementability, effectiveness, and cost for each discrete area. These technologies were combined into alternatives and screened in Section 5. Section 6 of the FS presented the remedial alternatives developed by combining the technologies identified in the previous screening process. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis, while preserving a range of options. Each alternative was then evaluated in detail in Section 8 of the FS.

In summary, of the 2 source control and 7 management of migration alternatives for the Landfill Lobes screened in Section 5 of the FS, 2 source control and 4 management of migration alternatives were retained as possible options for the cleanup of this area of the Site. From this initial screening, remedial options were combined, and 5 Landfill Lobe alternatives were selected for detailed analysis. For the Former Drum Disposal Area, of the 5 source control and 7 management of migration remedial alternatives screened in Section 5 of the FS, 3 source control and 4 management of migration alternatives were retained as possible options for cleanup of this area of the Site. From this initial screening, remedial options were combined, and 5 Former Drum Disposal Area alternatives were selected for detailed analysis. For the Garage and Storage Area, of the 4 source control remedial alternatives screened , 2 alternatives were retained as possible options and underwent detailed analysis. For the Downgradient Groundwater Area, of the 5 management of migration alternatives screened, 4 alternatives were retained as possible options for the cleanup of this area and underwent detailed analysis.

J. DESCRIPTION OF ALTERNATIVES

This Section provides a narrative summary of the alternatives evaluated for each of these areas of the Site:

- Landfill Lobes
- Former Drum Disposal Area
- Garage and Storage Area
- Downgradient Groundwater

1. Landfill Lobe Alternatives Analyzed

Each of the **5** Landfill Lobe alternatives is summarized below. A more complete, detailed presentation of each alternative is found in Section 8 of the FS (Detailed analysis of Landfill Lobe alternatives is found in attached **Tables LF-1 through LF-4**).

The Landfill Lobe alternatives analyzed for the Site include:

Alternative LF-1 – No Action

Alternative LF-2a –

- *Containment of Waste*

  Landfill Lobes will be capped with a low permeability RCRA Subtitle C waste cover system.

- *Restoration of Wetlands and Brook*

  Wetlands restoration will be required due to construction impacts (including excavation of approximately 750 cubic yards of contaminated sediments).

- *Partial Containment of Groundwater with a Vertical Barrier*

  Groundwater will be contained via a vertical barrier along a portion of the Southern Lobe to limit the direction of groundwater migration and to eliminate future impacts to Sutton Brook via groundwater discharge. The barrier is estimated to be 1,700 linear feet to a depth of approximately 30 feet below current grade.

- *Monitored Natural Attenuation (MNA) of Groundwater*

  Groundwater contamination will be addressed through natural attenuation processes. If necessary, active groundwater remediation (extraction and treatment or an enhanced in-situ technology) would be implemented. Discussion of criteria to be used in determining whether active groundwater remediation is necessary is located in Section L (The Selected Remedy).

- *Institutional Controls*

  This alternative will also include institutional controls to prohibit landfill excavation, restrict the future use/access to the landfill, and restrict the future use of groundwater until remedial goals are met.

- *Monitoring, Operation and Maintenance*

  This alternative will monitor groundwater, surface water, landfill gas and leachate, and conduct operation and maintenance activities for each component of the remedy (cap repairs, mowing, groundwater treatment plant operation, etc.).

Alternative LF-2b –

- *Containment of Waste*

  Landfill Lobes will be capped with a low permeability RCRA Subtitle C waste cover system.

- *Restoration of Wetlands and Brook*

  Wetlands restoration will be required due to construction impacts (including excavation of approximately 750 cubic yards of contaminated sediments).

- *Partial Containment of Groundwater with a Vertical Barrier*

  Groundwater will be contained via a vertical barrier along a portion of the Southern Lobe to limit the direction of groundwater migration and to eliminate future impacts to Sutton Brook via groundwater discharge. The barrier is estimated to be 1,700 linear feet to a depth of approximately 30 feet below current grade.

- *Active Groundwater Remediation*

  At the Southern Lobe, groundwater will be extracted and treated at the western edge of the lobe (at the end of the containment barrier). Due to the wide range of contaminants in groundwater, further pre-design studies will be required to develop the precise combination of treatment processes. The treatment processes will likely include metals precipitation, UV-oxidation, carbon adsorption and/or air stripping. Pre-design studies may also demonstrate that an enhanced in-situ technology may be appropriate. Treated groundwater will be discharged to the local publicly owned treatment works or to surface water on-site. Because of lower contaminant concentrations, natural attenuation processes would be utilized to address groundwater at the Northern Lobe.

- *Institutional Controls*

  This alternative will also include institutional controls to prohibit landfill excavation, restrict the future use/access to the landfill, and restrict the future use of groundwater until remedial goals are met.

- *Monitoring, Operation and Maintenance*

  This alternative will monitor groundwater, surface water, landfill gas and leachate, and conduct operation and maintenance activities for each component of the remedy (cap repairs, mowing, groundwater treatment plant operation, etc.).

Alternative LF-3 –

- *Containment of Waste*

  Landfill Lobes will be capped with a low permeability RCRA Subtitle C waste cover system.

- *Restoration of Wetlands and Brook*

  Wetlands restoration will be required due to construction impacts (including excavation of approximately 750 cubic yards of contaminated sediments).

- *Contaminated Groundwater Collection and Treatment*

  Groundwater extraction and treatment will be performed at the downgradient edges of both the Southern and Northern Lobes. Treated groundwater will be discharged to the local publicly owned treatment works or to surface water on-site.

- *Institutional Controls*

  This alternative will also include institutional controls to prohibit landfill excavation, restrict the future use/access to the landfill, and restrict the future use of groundwater until remedial goals are met.

- *Monitoring, Operation and Maintenance*

  This alternative will monitor groundwater, surface water, landfill gas and leachate, and conduct operation and maintenance activities for each component of the remedy (cap repairs, mowing, groundwater treatment plant operation, etc.).

Alternative LF-4 –

- *Containment of Waste*

  Landfill Lobes will be capped with a low permeability RCRA Subtitle C waste cover system.

- *Re-routing of the Brook*

  Sutton Brook will be re-routed along the southern edge of the Southern Lobe.

- *Excavation of Impacted Sediment Hot Spots*

  Contaminated sediments from the original brook bed will be excavated (approximately 750 cubic yards).

- *Partial Containment of Groundwater (Vertical Barrier)*

  Groundwater will be contained via a vertical barrier between the Southern Lobe and the re-routed brook. The barrier is intended to prevent recontamination of the brook from migration of contaminated groundwater.

- *Groundwater Remediation*

  At the Southern Lobe, groundwater will be extracted and treated at the western edge of the lobe (at the end of the containment barrier). Due to the wide range of contaminants in groundwater, further pre-design studies will be required to develop the precise combination of treatment processes. The treatment processes will likely include metals precipitation, UV-oxidation, carbon adsorption and/or air stripping. Pre-design studies may also demonstrate that an enhanced in-situ technology may be appropriate. Treated groundwater will be discharged to the local publicly owned treatment works or to surface water on-site. Because of lower contaminant concentrations, natural attenuation processes would be utilized to address groundwater at the Northern Lobe.

- *Institutional Controls*

  This alternative will also include institutional controls to prohibit landfill excavation, restrict the future use/access to the landfill, and restrict the future use of groundwater until remedial goals are met.

- *Monitoring, Operation and Maintenance*

  This alternative will monitor groundwater, surface water, landfill gas and leachate, and conduct operation and maintenance activities for each component of the remedy (cap repairs, mowing, groundwater treatment plant operation, etc.).

2. Former Drum Disposal Area Alternatives Analyzed

Each of the **5** Former Drum Disposal Area alternatives is summarized below. A more complete, detailed presentation of each alternative is found in Section 8 of the FS. (Detailed analysis of Former Drum Disposal Area alternatives is found in attached **Tables FDDA-1 through FDDA-5**).

The Former Drum Disposal Area alternatives analyzed for the Site include:

Alternative FDDA-1 – No Action

Alternative FDDA-2 –

- *Containment of Soils (with Cap)*

  Contaminated soils will be capped in place with a low permeability RCRA Subtitle C waste cover system.

- *Containment of Groundwater (through Extraction and Ex-Situ Treatment)*

  Groundwater will be extracted and treated to provide containment of the contaminated plume utilizing an estimated 4 extraction wells to act as a hydraulic barrier. Treated groundwater will be discharged to the local publicly owned treatment works or to surface water on-site.

- *Institutional Controls*

  This alternative will also include institutional controls to prohibit landfill excavation, restrict the future use/access to the landfill and to restrict the future use of groundwater until remedial goals are met.

- *Monitoring, Operation and Maintenance*

  This alternative will monitor groundwater, and conduct operation and maintenance activities (if necessary).

Alternative FDDA -3 –

- *Excavation, Treatment and/or Disposal of Soils*

  Approximately 8,900 cubic yards of soils contaminated in excess of site-specific cleanup levels will be excavated for consolidation in the Landfill Lobes prior to lobe capping. If it is determined to be more cost-effective, these soils may also be disposed of at an appropriate off-site facility.

- *Hydraulic Containment of Groundwater (through Extraction and Ex-Situ Treatment)*

  Groundwater will be extracted and treated to provide containment of the contaminated plume utilizing an estimated 4 extraction wells to act as a hydraulic barrier. Treated groundwater will be discharged to the local publicly owned treatment works or to surface water on-site.

- *Institutional Controls*

  This alternative will also include institutional controls to restrict the future use of groundwater until remedial goals are met.

- *Monitoring, Operation and Maintenance*

  This alternative will monitor groundwater, and conduct operation and maintenance activities (if necessary).

Alternative FDDA-4 –

- *Excavation, Treatment and/or Disposal of Soils*

  Approximately 8,900 cubic yards of soils contaminated in excess of site-specific cleanup levels will be excavated for consolidation in the landfill lobes prior to lobe capping. If it is determined to be more cost-effective, these soils may also be disposed of at an appropriate off-site facility.

- *Groundwater Remediation (Focused Mass Reduction)*

  Groundwater contamination will be addressed through natural attenuation processes. If necessary, active groundwater remediation (extraction and treatment or an enhanced in-situ technology) would be implemented. Discussion of criteria to be used in determining whether active groundwater remediation is necessary is located in Section L (The Selected Remedy).

- *Institutional Controls*

  This alternative will also include institutional controls to restrict the future use of groundwater until remedial goals are met.

- *Monitoring, Operation and Maintenance*

  This alternative will monitor groundwater, and conduct operation and maintenance activities (if necessary).

Alternative FDDA-5 –

- *Excavation, Treatment and/or Disposal of Soils*

  Approximately 8,900 cubic yards of soils, contaminated in excess of site-specific cleanup levels, will be excavated for consolidation in the landfill lobes prior to lobe capping. If it is determined to be more cost-effective, these soils may also be disposed of at an appropriate off-site facility.

- *Groundwater Extraction and Ex-Situ Treatment for Area-Wide Contaminant Reduction*

  Groundwater extraction and treatment will be implemented over the impacted area utilizing and estimated 5 extraction wells for an aggressive approach to meet groundwater cleanup levels in this area in an accelerated timeframe. Treated groundwater will be discharged to the local publicly owned treatment works or to surface water on-site.

- *Institutional Controls*

  This alternative will also include institutional controls to restrict the future use of groundwater until remedial goals are met.

- *Monitoring, Operation and Maintenance*

  This alternative will monitor groundwater, and conduct operation and maintenance activities (if necessary).

3. Garage and Storage Area Alternatives Analyzed

Both of the Garage and Storage Area alternatives are summarized below. A more complete, detailed presentation of each alternative is found in Section 8 of the FS.

Note: As described in Section G., this area was evaluated in the risk assessment as the Former Residence, Garage and Storage Area. The Former Residence portion of the property did not present a potential risk under the exposure pathways evaluated in the risk assessment by EPA. Because of this, alternatives were not developed for the Former Residence portion of the property, and the Former Residence is not referred to in the alternatives or Selected Remedy discussions.

(Detailed analysis of Garage and Storage Area alternatives is found in attached **Tables GSA-1 and GSA-2**).

The Garage and Storage Area alternatives analyzed for the Site include:

Alternative GSA-1 – No Action

Alternative GSA-2 –

- *Soil Excavation and Disposal*

  Soils contaminated in excess of site-specific cleanup levels, will be excavated for consolidation in the landfill lobes prior to lobe capping. If it is determined to be more cost-effective, these soils may also be disposed of at an appropriate off-site facility.

4. Downgradient Groundwater Alternatives Analyzed

Each of the **4** Downgradient Groundwater alternatives is summarized below. A more complete, detailed presentation of each alternative is found in Section 8 of the FS. (Detailed analysis of Downgradient Groundwater alternatives is found in attached **Tables DGGW-1 through DGGW-4**).

The Downgradient Groundwater alternatives analyzed for the Site include:

Alternative DGGW-1 – No Action

Alternative DGGW-2 –

- *In-Situ Remediation*

  Groundwater contamination will be addressed through natural attenuation processes with a contingency for active groundwater treatment if necessary. Discussion of criteria to be used in determining whether active groundwater remediation is necessary is located in Section L (The Selected Remedy).

- *Institutional Controls*

  This alternative will also include institutional controls to restrict the future use of groundwater until remedial goals are met.

- *Monitoring, Operation and Maintenance*

  This alternative will monitor groundwater, and conduct operation and maintenance activities (if necessary).

Alternative DGGW-3 –

- *Groundwater Containment and Treatment*

  Groundwater containment will be accomplished through extraction and treatment, utilizing an estimated 3 extraction wells to minimize downgradient migration of contaminated groundwater. Treated groundwater will be discharged to the local publicly owned treatment works or to surface water on-site.

- *Institutional Controls*

  This alternative will also include institutional controls to restrict the future use of groundwater until remedial goals are met.

- *Monitoring, Operation and Maintenance*

  This alternative will monitor groundwater, and conduct operation and maintenance activities (if necessary).

Alternative DGGW-4 –

- *Groundwater Extraction and Ex-Situ Treatment for Area-Wide Contaminant Reduction*

  This alternative is an aggressive approach, utilizing an estimated 10 extraction wells, that seeks contaminant mass reduction through groundwater extraction and ex-situ treatment of extensive volume of groundwater from throughout the downgradient groundwater area. Treated groundwater will be discharged to the local publicly owned treatment works or to surface water on-site.

- *Institutional Controls*

  This alternative will also include institutional controls to restrict the future use of groundwater until remedial goals are met.

- *Monitoring, Operation and Maintenance*

  This alternative will monitor groundwater, and conduct operation and maintenance activities (if necessary).

K. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that at a minimum EPA is required to consider in its assessment of alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the alternatives using the nine evaluation criteria in order to select a site remedy. The following is a summary of the comparison of each alternative's strength and weakness with respect to the nine evaluation criteria. These criteria are summarized as follows:

Threshold Criteria

The two threshold criteria described below must be met in order for the alternatives to be eligible for selection in accordance with the NCP:

1. **Overall protection of human health and the environment** addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with applicable or relevant and appropriate requirements (ARARs)** addresses whether or not a remedy will meet all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria or limitations, unless a waiver is invoked.

Primary Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria:

3. **Long-term effectiveness and permanence** addresses the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.

4. **Reduction of toxicity, mobility, or volume through treatment** addresses the degree to

which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the Site.

5. **Short term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.

6. **Implementability** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. **Cost** includes estimated capital and Operation Maintenance (O&M) costs, as well as present-worth costs.

Modifying Criteria

The modifying criteria are used as the final evaluation of remedial alternatives, generally after EPA has received public comment on the RI/FS and Proposed Plan:

8. **State acceptance** addresses the State's position and key concerns related to the preferred alternative and other alternatives, and the State's comments on ARARs or the proposed use of waivers.

9. **Community acceptance** addresses the public's general response to the alternatives described in the Proposed Plan and RI/FS report.

Following the detailed analysis of each individual alternative, a comparative analysis, focusing on the relative performance of each alternative against the nine criteria, was conducted. This comparative analysis can be found in Section 8 of the FS, as well as in Tables **9-1, 9-2, 9-3** and **9-4** of the FS, and attached to this ROD as Tables **K-1, K-2 K-3** and **K-4**.

The section below presents the nine criteria and a brief narrative summary of the alternatives and the strengths and weaknesses according to the detailed and comparative analysis for each of the areas evaluated in the FS. Only those alternatives which satisfied the first two threshold criteria were balanced and modified using the remaining seven criteria.

1. Landfill Lobes

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative *provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.*

All of the alternatives evaluated, with the exception of LF-1 (the No Action Alternative), will be protective of human health and the environment by eliminating, reducing, and controlling current and future risks through treatment, containment and/or institutional controls.

Alternatives, LF-2a, LF-2b, LF-3 and LF-4 address current and potential future exposure risks through institutional controls, containment and treatment (LF-2a with a contingency for an active groundwater treatment technology, if needed), restricting exposure to the landfill waste (through containment and institutional controls), and preventing the use of groundwater in this area until RAOs are attained.

Groundwater RAOs will be attained and exposure risks will be controlled with alternative LF-2 and LF-4 using containment (vertical barrier) and either in-situ natural attenuation processes (LF-2a with a contingency for an active groundwater treatment technology, if needed) or focused active treatment at the Southern Lobe and natural attenuation at the Northern Lobe (LF-2b); or with alternative LF-3 through groundwater extraction and ex-situ treatment at both lobes.

<u>Compliance with Applicable or Relevant and Appropriate Requirements</u>

Section 121(d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address hazardous substances, the remedial action to be implemented at the site, the location of the site, or other circumstances present at the site. Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law which, while not applicable to the hazardous materials found at the site, the remedial action itself, the site location or other circumstances at the site, nevertheless address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the site.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver.

Alternative LF-1 will not meet chemical specific ARARs as no remedial actions will be performed to reduce concentrations in sediments, surface water and groundwater. Alternatives LF-2a, LF-2b and LF-3 can be designed to comply with chemical, location and action specific ARARs. Attainment of chemical specific ARARs with regard to groundwater will not occur immediately, but rather, over a period of time once source control measures are implemented and in-situ or ex-situ remedial processes break down contaminants. The estimated timeframe to achieve the chemical specific ARARs for these alternatives (LF-2a, LF-2b and LF-4) are within the same order of magnitude, estimated to be in the 65 to 200 year range. Alternative LF-3, which incorporates groundwater extraction and ex-situ treatment, was estimated to meet cleanup goals in a slightly quicker timeframe (50 to 165 years). Alternative LF-4 can be designed and implemented to comply with applicable chemical and action specific ARARs; however the brook re-routing component of this alternative will most likely not meet location specific ARARs. Under *inter alia* Section 404 of the Clean Water Act and the Massachusetts Wetlands Protection Act, it must be demonstrated that there is no practicable alternative to LF-4 that would be less damaging, in terms of magnitude, to the resource areas. Because alternatives LF-2a, LF-2b and LF-3 present viable options that are less damaging to the existing on-site resource areas, the impacts to resource areas under LF-4 would not unavoidable.

As a result, alternatives LF-2a, LF-2b and LF-3 are the only alternatives that appear to be able to be designed and implemented to comply with all ARARs.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

With the exception of the No-Action alternative, all alternatives provide a comparable level of long term effectiveness and permanence in regards to the landfill waste. The effectiveness and permanence are dependent on the adequacy of maintenance.

Alternatives LF-2a, LF-2b and LF-3 which incorporate sediment excavation provide the highest level of long-term effectiveness for the brook sediments since the material is removed from the area, preventing current and potential future exposure. Alternative LF-4 is effective in reducing risks associated with the impacted sediments; however, since some of the contaminated sediments remain in place (and covered), the long-term effectiveness is reduced compared to LF-2a, LF-2b and LF-3.

For groundwater, each alternative (with the exception of the No-Action alternative) prevents future potential risks via institutional controls and/or groundwater remediation. Alternatives LF-2a, LF-2b and LF-4 use a combination of a permanent vertical barrier for containment and a focused groundwater remedial action at the downgradient end of the barrier. Alternative LF-2a incorporates a phased approach to the groundwater remedy, starting with monitored natural attenuation (MNA) with a contingency for active groundwater treatment based on the monitoring results. Alternatives LF-2b, LF-3 and LF-4 incorporate active treatment of groundwater (either in-situ technologies or extraction and ex-situ treatment).

Overall, LF-2a, LF-2b and LF-4 provide a higher level of reliability in groundwater containment over LF-3 since the vertical barrier is a permanent physical barrier; whereas, under alternative LF-3, containment is dependent upon groundwater extraction. LF-2a, LF-2b, LF-3 and LF-4 each have a good expectation of permanence. However, for each of these alternatives, some risk of contaminant rebound (after cleanup levels have been achieved) does exist, due to uncertainties of contaminant flow in groundwater. Permanence of the groundwater remedial actions must be evaluated over time (even following achievement of clean-up goals) to assess the ability to sustain the cleanup goals once the remedial action is complete

Reduction of Toxicity, Mobility or Volume Through Treatment
Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Treatment of the landfill waste or excavated brook sediments is not proposed or anticipated for any of the LF alternatives. While mobility of contaminants is expected to be greatly reduced due to the landfill cover system, this will not be accomplished through treatment.

Alternative LF-2a does not provide for active groundwater remediation unless the contingency for active groundwater remediation is triggered. Active groundwater treatment (either extraction and ex-situ or enhanced in-situ) is a component of alternatives LF-2b, LF-3 and LF-4, with LF-3 expected to provide the greatest reduction of toxicity and volume through treatment, due to larger number of extraction wells, and volume of water to be extracted and treated. LF-2b provides for active groundwater treatment at the Southern Lobe and monitored natural attenuation at the Northern Lobe.

Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until cleanup goals are achieved.

No short-term impacts to the local community, on-site remedial workers or the environment will occur under alternative LF-1. At the present time, South Street in Tewksbury is the only road with access to the Site. Impacts from alternatives LF-2a, LF-2b, LF-3 and LF-4 to the local community are expected to be significant due to the increased truck traffic during construction activities. Concerns about the potentially significant additional truck traffic on South Street have been vocalized by the community.

For the groundwater component of the alternative, the short-term impacts to the local community, on-site remedial workers and the environment are anticipated to be slightly higher for LF-3 due to the lengthier construction time and the larger impacts to the wetlands (during extraction well and piping installation). Alternatives LF-2b and LF-4 are comparable for the groundwater component of the remedy with LF-2a being lower assuming fewer construction/installation components.

For the sediment/ brook component of the alternative, however, alternative LF-4 will provide the highest short term impacts to the local community, on-site remedial works and the environment compared to LF-2a, LF-2b and LF-3 due to the increased construction time and the increased amount of resource area impacted during the brook filling and re-routing.

<u>Implementability</u>

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

For the landfill final cover system, all of the alternatives are readily implementable, as they require no construction (LF-1) or common construction activities (landfill final cover system) that are straightforward to implement (LF-2 through LF-4). The presence of the wetland resource areas and Sutton Brook surrounding the landfill lobes will present some challenges with the design and construction; however, they are comparable for LF-2 through LF-4.

The groundwater component for alternative LF-1 is easily implementable since no construction activities are requireded to be implemented. Installation of the vertical barrier for LF-2 and LF-4 is a common construction activity, readily implementable; however, there may be some design and construction challenges that will require coordination in conjunction with the final landfill cover system design and construction due to the proximity of the brook and the edge of waste (Southern Lobe). Installation of the groundwater extraction and treatment system for LF-3 is straightforward; however, LF-3 has similar design and construction issues as LF-2 and LF-4 due to the proximity of the edge of waste to the wetlands and brook. Detailed pre-design, pilot, and/or bench scale studies will be required for LF-2b, LF-3, and LF-4 (and potentially LF-2a) to allow effective design and implementation of the remedial action.

The brook sediment component of the landfill alternatives is straightforward and readily implementable for LF-2 and LF-3; sediment removal and brook restoration with LF-2 and LF-3 will present significantly fewer challenges to implement than re-routing the brook with LF-4, both in design and construction.

All materials and services required for implementation are readily available either commercially or via specialized vendors for all alternatives.

Cost

LF-1 $ 0
LF-2a $ 20.52 million
LF-2b $ 25.22 million
LF-3 $ 40.93-51.13 million
LF-4 $ 31.42 million

Note: The cost estimate for Alternative LF-2a assumes that MNA will be sufficient. The estimated additional cost to implement the active groundwater contingency for Alternative LF-2a is $4.7 million

Back-up information supporting the costs for these alternatives can be found in Appendix D of the FS.

State Acceptance

The Commonwealth of Massachusetts has indicated its support for the selected remedy by providing its concurrence in the attached letter (see Appendix A).

Community Acceptance

From June 28, 2007 through July 28, 2007, EPA held a public comment period to seek input from the community regarding remedial cleanup alternatives evaluated for the Site. In addition to written comments provided to EPA, comments were received during a Public Hearing held on July 18, 2007.

Concern was expressed by many commenters regarding potential negative impacts from trucking activities associated with all Landfill Lobes alternatives. The development and/or use of an alternate route to access the site was urged. A summary of the comments received and EPA's response to comments is included in the Responsiveness Summary portion of this ROD (Part 3).

2. Former Drum Disposal Area

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks *posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.*

All of the alternatives, with the exception of FDDA-1, will be protective of human health and the environment by eliminating, reducing, or controlling current and future risks through treatment, containment and/or institutional controls.

Alternatives FDDA-2 through FDDA-5 all address current exposure risks through institutional controls, restricting potable use of groundwater, soil removal or containment, and groundwater remediation, until RAOs are attained. Groundwater RAOs will be attained with alternative FDDA-4 using in-situ natural attenuation processes with a contingency for active groundwater treatment and with alternatives FDDA-2, FDDA-3 and FDDA-5 through groundwater extraction and ex-situ treatment.

For the impacted soils, alternative FDDA-2 utilizes a containment barrier (e.g. low permeability cap) and institutional controls to control exposure. Alternatives FDDA-3 through FDDA-5 all incorporate soil excavation to eliminate exposure risks associated with the impacted soils (as well as eliminating the need for cap maintenance).

<u>Compliance with Applicable or Relevant and Appropriate Requirements</u>

Section 121(d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address hazardous substances, the remedial action to be implemented at the site, the location of the site, or other circumstances present at the site. Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law which, while not applicable to the hazardous materials found at the site, the remedial action itself, the site location or other circumstances at the site, nevertheless address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the site.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver.

Alternative FDDA-1 will not meet chemical specific ARARs as no remedial actions will be performed to reduce concentrations in soils and groundwater. The remaining alternatives can be designed to comply with chemical, location and action specific ARARs (summarized in Appendix D and in Section 3 of the Feasibility Study). Attainment of chemical specific ARARs with regard to groundwater will not occur immediately, but rather, over a period of time once source control measures are implemented and in-situ or ex-situ treatment processes break down contaminants. The estimated timeframe to achieve groundwater chemical specific ARARs for alternatives FDDA-3, FDDA-4, and FDDA-5 are within the same order of magnitude (24 to 89 years for FDDA-3, 36 to 103 years for FDDA-4, and 23 to 85 years for FDDA-5) since the source material is removed, with a differential of approximately 10 to 15 years between the slowest and quickest alternatives primarily due to whether the groundwater component has active treatment or MNA. Alternative FDDA-2 has a wider range in the estimated timeframe (30 to 134 years) to meet groundwater ARARs due to the uncertainty of timeframes for soil contaminants to leach into groundwater. The alternatives that incorporate groundwater extraction and ex-situ treatment with soil excavation (FDDA-3 and FDDA-5) were estimated to meet cleanup goals in the quickest timeframe of approximately 23 to 89 years, but not significantly quicker than FDDA-4 (36 to 103 years), which utilizes MNA.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

The three alternatives that incorporate soil excavation (FDDA-3, FDDA-4, and FDDA-5) provide the highest level of long-term effectiveness and permanence, since the material is removed from the area, preventing the potential for direct contact, as well as future leaching of contaminants from soils to groundwater. Alternative FDDA-2 is effective in reducing risks associated with the impacted soils; however, since the material remains in place, the long-term effectiveness is reduced compared to FDDA-3, FDDA-4, and FDDA-5. Even with an impermeable barrier, the potential exists for future leaching into groundwater since residuals remain.

Alternatives FDDA-2 through FDDA-5 each prevent future potential risks via institutional controls and various forms of remedial actions. Alternative FDDA-5 is the more aggressive option as it extracts groundwater over the entire FDDA plume potentially resulting in a reduced timeframe to achieve RAOs compared to the other FDDA alternatives (although modeling does not demonstrate the potential advantage – FDDA-3 and FDDA-5 are both estimated to meet cleanup goals in approximately 23-89 years). Alternatives FDDA-2 and FDDA-3 are similar to FDDA-5 in that they involve groundwater extraction and treatment; however, the goal is hydraulic containment/contaminant reduction. Because of this, in Alternatives FDDA-2 and FDDA-3, groundwater is extracted only along the downgradient edge of the FDDA. Alternative FDDA-4 capitalizes on existing natural attenuation processes occurring in this area with a contingency for active groundwater treatment to provide long-term effectiveness and permanence.

Alternatives FDDA-2 through FDDA-5 all have a good expectation of permanence. However, some risk of contaminant rebound (after cleanup levels have been achieved) does exist, due to uncertainties of contaminant flow in groundwater. Permanence of the groundwater remedial actions must be evaluated over time (even following achievement of clean-up goals) to assess the ability to sustain the cleanup goals once the remedial action is complete.

<u>Reduction of Toxicity, Mobility or Volume Through Treatment</u>

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Treatment of impacted soils is not proposed for any of the FDDA alternatives. Therefore, although mobility is expected to be greatly reduced by cover systems in all alternatives, this reduction will not be achieved through treatment.

The toxicity and volume of contaminants in groundwater will be reduced for alternatives FDDA-2, FDDA-3 and FDDA-5 through ex-situ treatment technologies, and the migration of contaminants will be reduced via the groundwater extraction component of the treatment system. FDDA-4 does not provide for active groundwater remediation unless the contingency for active groundwater remediation is triggered. The contaminant mass destroyed in groundwater through treatment will be comparable for alternatives FDDA-3 and FDDA-5. If the contingency for active groundwater remediation is triggered, the contaminant mass destroyed in groundwater through treatment in alternative FDDA-4 will be comparable to alternatives FDDA-3 and FDDA-5. Since a larger contaminant mass will be present within the FDDA with alternative FDDA-2 because no soil excavation would occur, this groundwater component will likely treat a higher amount of mass during its operation when compared to FDDA-2, FDDA-3 and FDDA-5.

<u>Short-Term Effectiveness</u>

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until cleanup goals are achieved.

The three alternatives that incorporate soil excavation (FDDA-3, FDDA-4, and FDDA-5) provide the highest level of short-term effectiveness since the material is removed from the area.

The short-term implementation impacts are anticipated to be slightly higher for FDDA-2, FDDA-3 and FDDA-5. Due to the location of extraction wells and the need for access roads to each well (access for O&M and for installation of extraction piping and electrical conduit), slightly higher impacts to the adjacent wetland resource area are anticipated. FDDA-5 will require the most disruption/destruction, with FDDA-2 and FDDA-3 reduced, yet comparable to one another.

The estimated timeframe to achieve RAOs for alternatives FDDA-3, FDDA-4, and FDDA-5 are within the same order of magnitude since the source material is removed, with the quickest timeframe estimated for FDDA-5, followed by FDDA-3. Alternative FDDA-2 has the potential to be the lengthiest timeframe since infiltration is reduced (but not eliminated) through the cap.

Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

For the soil component, all alternatives are easily implementable, requiring common construction activities.

For the groundwater component, while FDDA-4 requires little construction when compared with FDDA-2, FDDA-3 and FDDA-5, all alternatives can be implemented readily.

All materials and services required for implementation are readily available either commercially or via specialized vendors for all alternatives.

Cost

FDDA-1 $ 0
FDDA-2 $ 7.53-8.33 million
FDDA-3 $ 7.62-9.22 million
FDDA-4 $ 2.81 million
FDDA-5 $ 9.93-12.33 million

Note: The cost estimate for Alternative FDDA-4 assume that MNA will be sufficient. The estimated additional cost to implement the active groundwater contingency for Alternative FDDA-4 is $4.5 million

Back-up information supporting the costs for these alternatives can be found in Appendix D of the FS.

State Acceptance
The Commonwealth of Massachusetts has indicated its support for the selected remedy by providing its concurrence in the attached letter (see Appendix A).

Community Acceptance

From June 28, 2007 through July 28, 2007, EPA held a public comment period to seek input from the community regarding remedial cleanup alternatives evaluated for the Site. In addition to written comments provided to EPA, comments were received during a Public Hearing held on July 18, 2007.

Comments were received in support of Alternative FDDA-4, as well as in support of FDDA-3 which has active groundwater treatment as a component. A summary of the comments received and EPA's response to comments is included in the Responsiveness Summary portion of this ROD (Part 3).

3. Garage and Storage Area

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

Alternative GSA-1 (No Action) is the least protective of the two options as no action would be taken to eliminate or control exposure risks. Potential future risks would remain and RAOs will not be achieved. Alternative GSA-2 will effectively eliminate current and/or potential future exposure risks as the material will be excavated and removed from the GSA.

Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address hazardous substances, the remedial action to be implemented at the site, the location of the site, or other circumstances present at the site. Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law which, while not applicable to the hazardous materials found at the site, the remedial action itself, the site location or other circumstances at the site, nevertheless address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the site.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver.

Alternative GSA-1 will not meet chemical specific ARARs as no remedial actions will be performed to reduce contaminant concentrations in soils. Alternative GSA-2 can be designed to comply with chemical, location and action specific ARARs.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

Through excavation and disposal beneath the landfill final cover system, alternative GSA-2 will provide long term effectiveness and permanence as residual risks will be eliminated within the GSA area.

Reduction of Toxicity, Mobility or Volume Through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

Treatment of the impacted soils is not proposed or anticipated for GSA-2.

Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until cleanup goals are achieved.

The short-term impacts from Alternative GSA-2 are anticipated to be minimal and controllable due to the relatively small volume of soils requiring removal, the short duration of construction activity and the proximity to on-site disposal areas.

RAOs will be met for GSA-2 upon removal of the impacted soils, anticipated after 1 to 2 years (includes timing for design, implementation, and confirmatory analysis).

Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design *through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.*

GSA-2 is readily implementable. Soil excavation is a common technique, straight forward and reliable to implement.

Cost

GSA-1 $ 0
GSA-2 $ 200,000

Back-up information supporting the costs for these alternatives can be found in Appendix D of the FS.

State Acceptance
The Commonwealth of Massachusetts has indicated its support for the selected remedy by providing its concurrence in the attached letter (see Appendix A).

Community Acceptance
From June 28, 2007 through July 28, 2007, EPA held a public comment period to seek input from the community regarding remedial cleanup alternatives evaluated for the Site. In addition to written comments provided to EPA, comments were received during a Public Hearing held on July 18, 2007.

A summary of the comments received and EPA's response to comments is included in the Responsiveness Summary portion of this ROD (Part 3).

4. Downgradient Groundwater Area

Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

All of the alternatives, with the exception of DGGW-1, will be protective of human health and the environment under this scenario by eliminating, reducing, or controlling current and future risks through remedial actions and/or institutional controls.

Alternative DGGW-1 is the least protective of the four options as no action would be taken to reduce concentrations in groundwater or to control exposure risks. Under this alternative, there would be no restrictions on groundwater use. The three remaining alternatives, DGGW-2, DGGW-3, and DGGW-4, all address current exposure risks through institutional controls, restricting potable use of groundwater in this area until RAOs are attained. Groundwater RAOs will be attained with alternative DGGW-2 using in-situ natural attenuation processes (with a contingency for an active treatment component based on the monitoring results) and with alternatives DGGW-3 and DGGW-4 through groundwater extraction and ex-situ treatment.

Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA requires that remedial actions at CERCLA sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Applicable requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address hazardous substances, the remedial action to be implemented at the site, the location of the site, or other circumstances present at the site. Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law which, while not applicable to the hazardous materials found at the site, the remedial action itself, the site location or other circumstances at the site, nevertheless address problems or situations sufficiently similar to those encountered at the site that their use is well-suited to the site.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver.

Alternative DGGW-1 will not meet chemical specific ARARs as no remedial actions will be performed to reduce contaminant concentrations in groundwater. The remaining alternatives can be designed to meet chemical, location, and action specific ARARs. Attainment of chemical specific ARARs will not occur in the immediate short-term, but rather, over a period of time once source control measures are implemented and in-situ or ex-situ treatment processes break down contaminants. The estimated timeframe to achieve chemical specific ARARs for alternatives DGGW-2 (67-79 years), DGGW-3 (57-68 years), and DGGW-4 (53-66 years) are within the same order of magnitude.

Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk and the *adequacy and reliability of controls.*

Alternatives DGGW-2, DGGW-3, and DGGW-4 prevent future potential risks via institutional controls and various forms of remedial actions.

Alternative DGGW-4 is the most aggressive option as it extracts groundwater over the entire DGGW plume, potentially resulting in a reduced time to achieve RAOs compared to the other DGGW alternatives. Alternative DGGW-3 is similar to DGGW-4 in that it involves groundwater extraction and treatment, but with fewer extraction wells and lower extraction rate. Alternative DGGW-2 capitalizes on existing natural attenuation processes occurring in this area and, with a contingency for active groundwater treatment based on the monitoring results, provides long-term effectiveness and permanence.

As with the previous groundwater remedies, some risk of contaminant rebound (after cleanup levels have been achieved), does exist, due to uncertainties of contaminant flow in groundwater. Permanence of the groundwater remedial actions must be evaluated over time (even following achievement of clean-up goals) to assess the ability to sustain the cleanup goals once the remedial action is complete.

<u>Reduction of Toxicity, Mobility or Volume Through Treatment</u>

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

DGGW-2 utilizes natural attenuation processes to address groundwater contamination and therefore does not meet the treatment requirements for this criteria (unless the contingency for active treatment is triggered). However, the processes will be permanent, with no treatment residuals to handle. The toxicity and volume of contaminants in groundwater will be reduced for alternatives DGGW-3 and DGGW-4 through ex-situ treatment technologies; the migration of contaminants will be reduced via the groundwater extraction component of the treatment system. The mass destroyed through treatment will be comparable for alternatives DGGW-3 and DGGW-4, however, the timeframe to destroy the mass has been assumed to be expedited with DGGW-4. It is anticipated that alternatives DGGW-3 and DGGW-4 will produce residuals requiring off-site disposal (e.g. sludge from metals treatment) or treatment (e.g. carbon).

<u>Short-Term Effectiveness</u>

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until cleanup goals are achieved.

The short-term impacts to the local community and on-site remedial workers are anticipated to be minimal for all alternatives. However, the impacts to the environment, specifically the wetland resource area, from alternatives DGGW-3 and DGGW-4 are anticipated to be high. With the installation of groundwater extraction wells throughout the DGGW area, destruction of wetlands will be required to access, install, and maintain the groundwater extraction wells. In addition, a gravel roadway (accessible by vehicle) will be required to each extraction point to access the well and for installation of the extraction piping and utility conduits. With fewer extraction wells, DGGW-3 will require significantly less destruction of the wetland resource area (anticipated 5,050 sq ft) compared to DGGW-4 (anticipated 35,740 sq ft).

Impacts under DGGW-2 are anticipated to be minimal during installation of additional monitoring wells and during monitoring activities. Access to wells during long-term monitoring events can be on foot, not requiring access roads through the wetlands.

As discussed above, the estimated timeframe to achieve RAOs for alternatives DGGW-2 through DGGW-4 are within the same order of magnitude. Through modeling, alternative DGGW-4 (53-66 years) is anticipated to achieve RAOs quickest, followed by DGGW-3 (57-68 years) and then DGGW-2 (67-79 years).

Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

DGGW-2 is easily implementable since limited construction activities are required to be implemented. As discussed above, installation of the groundwater extraction and treatment systems for DGGW-3 and DGGW-4 will present potential construction issues, with access concerns, destruction of wetlands, etc. Potential issues with discharging the treated groundwater (due to excessive volume) may arise if one of these alternatives (DGGW-3 or DGGW-4) is coupled with other high volume extraction rate alternatives (e.g. LF-3). The POTW or surface water can handle the discharge from an individual alternative; however in the event that more than one alternative requiring discharge is implemented, an evaluation will be required to determine if one discharge method will be sufficient, or if a combination of discharge methods will be required. Despite these issues, DGGW-3 and DGGW-4 are implementable.

All materials and services required for implementation are readily available either commercially or via specialized vendors for all alternatives. None of the proposed alternatives should significantly limit potential further remedial actions, if required.

Cost

DGGW-1 $ 0
DGGW-2 $ 1.75 million
DGGW-3 $ 9.83-12.83 million
DGGW-4 $ 11.13-16.83 million

Note: The cost estimate for Alternative DGGW-2 assumes that MNA will be sufficient. The estimated additional cost to implement the active groundwater contingency for Alternative DGGW-2 is $2.5 million

Back-up information supporting the costs for these alternatives can be found in Appendix D of the FS.

State Acceptance
The Commonwealth of Massachusetts has indicated its support for the selected remedy by providing its concurrence in the attached letter (see Appendix A).

Community Acceptance
From June 28, 2007 through July 28, 2007, EPA held a public comment period to seek input from the community regarding remedial cleanup alternatives evaluated for the Site. In addition to written comments provided to EPA, comments were received during a Public Hearing held on July 18, 2007.

A summary of the comments received and EPA's response to comments is included in the Responsiveness Summary portion of this ROD (Part 3).

L. THE SELECTED REMEDY

1. Summary of the Rationale for the Selected Remedy

The selected remedy is a comprehensive remedy which utilizes source control and management of migration components to address the principal site risks.

The major components of the remedy include the following:

- Excavation of contaminated soils exceeding site-specific cleanup levels from the Former Drum Disposal Area (FDDA) and the former Garage and Storage Area (GSA);
- Excavation of contaminated soils and sediments exceeding site-specific cleanup levels from a portion of Sutton Brook between the two landfill lobes;

- Consolidation of excavated soils and sediments along with other debris adjacent to the landfills into the landfills;
- Construction of a low permeability cap over both landfill lobes, including systems to collect and manage gases and storm water from the landfills;
- Construction of a vertical barrier to intercept groundwater from the southern landfill lobe to prevent it from entering Sutton Brook;
- Collection and treatment of contaminated groundwater from an area west of the southern landfill lobe;
- Monitored natural attenuation of areas of groundwater contamination not captured by the extraction system, with a contingency to expand the area of active groundwater remediation, if necessary;
- Institutional controls such as deed restrictions and/or local ordinances to prevent unacceptable exposures to wastes left in place and to restrict exposure to contaminated groundwater until cleanup levels are met; and
- Long-term groundwater, surface water, and sediment monitoring, and periodic five-year reviews of the remedy.

The capping and excavation components of the remedy will prevent direct contact with contaminants by human and ecological receptors. In addition these components will prevent migration of contaminants to groundwater and surface water.

The groundwater component of the remedy will prevent consumption of and exposure to groundwater contaminants above site specific cleanup levels by human receptors. In addition, the remedy will prevent recontamination of Sutton Brook and associated sediments.

2. Description of Remedial Components

The selected remedy is consistent with EPA's preferred alternative outlined in the June 2007 Proposed Plan and is consistent with a combination of all or a portion of Alternatives LF-2b, FDDA-4, GSA-2, and DGGW-2, outlined in the June 2007 Feasibility Study. The selected remedy is generally depicted in Figures L-1, L-2 and L-3.

Landfill Lobes - *Alternative LF-2b*

- *Containment of Waste*

The selected remedy includes capping of both the Northern and Southern Landfill Lobes with a low permeability RCRA Subtitle C waste cover system. Prior to capping, miscellaneous debris piles adjacent to the landfill will be consolidated into the area to be capped. Construction will include grading the Landfill Lobes and installation of a low permeability RCRA (Resource Conservation and Recovery Act) Subtitle C hazardous waste cover system over both Landfill Lobes, totaling approximately 40 acres. The specific makeup of the cap layers will be determined during remedial design. It is expected, however, that, at a minimum, the cap will include a gas vent layer, a HDPE geomembrane, drainage layer, and vegetative cover. In addition, a landfill gas collection system, storm-water drainage structures (swales, rip-rap, perimeter drains), and detention basins, as necessary, will be constructed as part of the remedy.

- *Restoration of Wetlands and Brook*

Contaminated sediments in Sutton Brook (between the Landfill Lobes) exceeding cleanup levels will be excavated and consolidated into the Landfill Lobes. It is estimated that this would involve excavation of approximately 750 cubic yards of contaminated sediments. Impacted areas of the brook will be restored, including re-planting of appropriate vegetation. Precautions will be taken to minimize the long-term impact to wetland areas as part of construction. Wetland areas lost or impacted due to remediation of the brook and/or capping of the landfills will be mitigated for in other areas of the Site.

- *Partial Containment of Groundwater with a Vertical Barrier*

A vertical barrier will be constructed along a portion of the Southern Lobe to limit the direction of groundwater migration and to eliminate future impacts to Sutton Brook via groundwater discharge. The barrier is estimated to be 1,700 linear feet with a depth of approximately 30 feet below current grade. The type of impermeable vertical barrier (e.g., sheet pile, slurry wall, etc.) will be determined during remedial design. Contaminated groundwater from the Southern Lobe is currently discharging to Sutton Brook, or is initially migrating in a westerly direction and discharging to Sutton Brook further downstream. The intent of the installation of this vertical barrier is for groundwater contaminants to migrate towards the west and through the "Area for Focused Groundwater Treatment," bringing high concentrations of additional contamination through this area for subsequent treatment. In order to prevent migration of contaminated groundwater under the vertical barrier, the base of the barrier will be "tied-in" to an impermeable, or low-permeability layer (e.g., till or bedrock).

- *Groundwater Remediation*

The selected remedy calls for the extraction and treatment of groundwater at the Southern Lobe at the "Area for Focused Groundwater Treatment" at the western limit of the vertical containment barrier. Figure L-1 shows the proposed locations for the vertical barrier and groundwater collection/treatment. Due to the wide range of contaminants in groundwater, further pre-design studies will be required to develop the precise combination of processes, but they will likely include a combination of metals precipitation, UV-oxidation, carbon adsorption, and/or air stripping. If appropriate, pre-design studies may also demonstrate that one or more enhanced in-situ technologies may be effective. Cost estimates for this portion of the remedy were based on the assumption that contaminated groundwater at the western/northwestern end of the Southern Lobe will be intercepted by a series of groundwater extraction wells pumping at a rate of 15 gallons per minute. The number of wells and the necessary pumping rate will be determined during remedial design. Treated groundwater is expected to be discharged to the local publicly owned treatment works (POTW); however, on-site discharge to Sutton Brook (or other on-site location) will be evaluated as part of remedial design. Design of the groundwater component of this portion of the remedy will take into account the contingency for active groundwater treatment outlined for other areas of the Site. That is, a single treatment plant may be constructed with the ability to handle potential additional flows from potential future extraction wells from other areas of the Site. As discussed earlier, groundwater at the Northern Lobe exhibits significantly lower contaminant concentrations than groundwater at the Southern Lobe. Because of the lower contaminant concentrations, monitored natural attenuation (MNA) utilizing ongoing natural processes is the remedy for groundwater at the Northern Lobe.

- *Institutional Controls*

The remedy will also include institutional controls to prohibit landfill excavation, restrict the future use of and access to the landfill, and restrict the future use of groundwater until remedial goals are met. The type of institutional control(s) will be evaluated and selected during remedial design. See <u>Institutional Controls</u> section below for additional information.

- *Monitoring, Operation and Maintenance*

The remedy will include monitoring of groundwater, surface water, landfill gas and leachate; monitoring of wetlands to determine the success of wetlands mitigation and restoration; as well as operation and maintenance activities for each component of the remedy (cap repairs, mowing, groundwater treatment plant operation, etc.). See also <u>Long Term Monitoring and Five-Year Reviews</u> section below.

The Landfill Lobes portion of the remedy will achieve RAOs by: capping the waste to prevent contact, surface water runoff, and leaching; preventing exposure to contaminated groundwater by actively treating some groundwater, removing contamination sources and addressing other groundwater through MNA; and preventing the migration of groundwater contamination to Sutton Brook surface water and sediments, by the installation of a vertical barrier.

The total cost of the Landfill Lobes portion of the remedy is $25.22 million.

<u>Former Drum Disposal Area</u> - *Alternative FDDA-4*

- *Excavation, Treatment and/or Disposal of Soils*

As part of the selected remedy, soils (approximately 8,900 cubic yards) contaminated in excess of site-specific cleanup levels will be excavated and consolidated into the landfill lobes prior to lobe capping. If it is determined to be more cost-effective, these soils may also be disposed of at an appropriate off-site facility. Removal of the remaining source material will eliminate future leaching into groundwater and expedite the timeframe to meet groundwater cleanup levels. A conceptual plan is shown in Figure L-2. Excavated areas will be restored with clean fill.

- *Groundwater Remediation (Focused Mass Reduction)*

The selected remedy will address groundwater contamination in this area through natural attenuation processes. Upon completion of source area remedial measures (FDDA excavation), a monitored natural attenuation (MNA) program will be initiated. As discussed earlier, analytical and geochemical data have indicated that natural attenuation processes are occurring within and downgradient of the source areas. These natural in-situ attenuation processes include biodegradation, dispersion, dilution, adsorption, volatilization, and chemical or biological stabilization, transformation, or destruction of contaminants. Groundwater modeling predicts that the time needed to achieve RAOs using MNA is comparable to other alternatives. Groundwater flow, geochemistry, contaminant distribution and migration will be monitored. See also Long Term Monitoring and Five-Year Reviews section below. The selected remedy also includes a contingency for implementation of active groundwater remediation (extraction and treatment or an enhanced in-situ technology), if necessary.

Once the source control measures are implemented, monitoring will be performed to determine the resulting flow regime, as well as to evaluate, on an ongoing basis, contaminant levels and whether existing site conditions continue to support the use of MNA to address groundwater RAOs. The purpose of the monitoring program is to:

- Demonstrate that natural attenuation is occurring according to expectations;
- Detect changes in environmental conditions that may reduce the efficacy of any natural attenuation processes;
- Identify any potentially toxic and/or mobile transformation products;
- Verify that the plume is not expanding;
- Verify that there are no unacceptable impacts to downgradient receptors;
- Detect any new releases of contaminants to the environment that could impact the effectiveness of the natural attenuation remedy; and
- Verify attainment of remedial objectives.

Groundwater will be monitored on a quarterly basis for a minimum of five years for the purpose of monitoring and evaluating the MNA portion of the remedy. After five years, EPA will determine if quarterly monitoring of groundwater remains necessary or if a different interval is appropriate for monitoring groundwater.

EPA will evaluate the progress of the MNA portion of the remedy toward achieving RAOs as data become available, but no less frequently than during the 5-Year Reviews conducted for the Site. The following criteria are among those which will be considered to determine whether MNA continues to be the appropriate remedy to address groundwater contamination:

- Contaminant concentrations in groundwater at specified locations exhibit an increasing trend not originally predicted during remedy selection;

- Near-source wells exhibit large concentration increases indicative of a new or renewed release;
- Contaminants are identified in monitoring wells located outside of the original plume boundary;
- Contaminant concentrations are not decreasing at a sufficiently rapid rate to meet the remediation objectives; and
- Changes in land and/or groundwater use will adversely affect the protectiveness of the MNA remedy.

If EPA determines that MNA is no longer an appropriate remedy to effectively achieve groundwater RAOs, a contingent remedy involving the extraction and treatment of groundwater will be designed and implemented.

If a groundwater extraction and treatment system is implemented, extracted groundwater would either be directed to the treatment plant constructed as part of Landfill Lobes portion of the remedy or to a second treatment plant designed along the same parameters as outlined in the Landfill Lobes portion of the remedy above.

- *Institutional Controls*

The remedy will also include institutional controls to restrict the future use of groundwater until remedial goals are met. The type of institutional control(s) will be evaluated and selected during remedial design. See Institutional Controls section below for additional information.

- *Monitoring, Operation and Maintenance*

The remedy will include long-term monitoring of groundwater. Monitoring will continue at least until groundwater RAOs are attained. Operation and maintenance activities would also be required should the contingent remedy be implemented.

The FDDA portion of the remedy will achieve RAOs by: removing the contamination source material to prevent direct contact/ingestion/inhalation of residual levels of contaminants in soils as well as preventing leaching of contaminants from soils to groundwater; and utilizing MNA processes to address groundwater contamination. If monitoring criteria determine that MNA is not adequate, active groundwater remediation will be implemented.

The cost of the FDDA portion of the remedy is $2.81 million.

The estimated additional cost to implement the active groundwater contingency for the FDDA is $4.5 million.

Garage and Storage Area - *Alternative GSA–2*

- *Soil Excavation and Disposal*

The selected remedy calls for excavation of soils contaminated in excess of site-specific risk-based cleanup levels (approximately 530 cubic yards) and consolidation in the Landfill Lobes prior to lobe capping. If it is determined to be more cost-effective, these soils may also be disposed of at an appropriate off-site facility. A conceptual excavation plan is shown in Figure L-2. Excavated areas will be restored with clean fill.

The GSA portion of the remedy achieves RAOs by excavating and removing the contaminated soils.

Monitoring, Operation and Maintenance, and Institutional Controls will not be necessary at the Garage and Storage Area.

The cost of the GSA portion of the remedy is $ 200,000.

Downgradient Groundwater - *Alternative DGGW-2*

- *In-Situ Remediation*

Groundwater contamination will be addressed through natural attenuation processes with a contingency for active groundwater treatment if necessary in the future. Based upon the source control remedies and the groundwater remediation outlined for other areas of the Site, active groundwater extraction and treatment in the downgradient groundwater portion of the plume will not be included as part of the initial remedy. As discussed earlier, analytical and geochemical data have indicated that natural attenuation processes are occurring within and downgradient of the source areas. These natural in-situ attenuation processes include biodegradation, dispersion, dilution, adsorption, volatilization, and chemical or biological stabilization, transformation, or destruction of contaminants. Groundwater modeling predicts that the time needed to achieve RAOs using MNA is comparable to other alternatives. Groundwater flow, geochemistry, contaminant distribution and migration will be monitored. See also Long Term Monitoring and Five-Year Reviews section below. The selected remedy also includes a contingency for implementation of active groundwater remediation (extraction and treatment or an enhanced in-situ technology), if necessary.

Once the source control measures are implemented, monitoring will be performed to determine the resulting flow regime, as well as to evaluate, on an ongoing basis, contaminant levels, and whether existing site conditions continue to support the use of MNA to address groundwater RAOs. The purpose of the monitoring program is to:

- Demonstrate that natural attenuation is occurring according to expectations;
- Detect changes in environmental conditions that may reduce the efficacy of any natural attenuation processes;

- Identify any potentially toxic and/or mobile transformation products;
- Verify that the plume is not expanding;
- Verify that there are no unacceptable impacts to downgradient receptors;
- Detect any new releases of contaminants to the environment that could impact the effectiveness of the natural attenuation remedy; and
- Verify attainment of remedial objectives.

Groundwater will be monitored on a quarterly basis for a minimum of five years for the purpose of monitoring and evaluating the MNA portion of the remedy. After five years, EPA will determine if quarterly monitoring of groundwater remains necessary or if a different interval is appropriate for monitoring groundwater.

EPA will evaluate the progress of the MNA portion of the remedy toward achieving RAOs as data become available, but no less frequently than during the 5-Year Reviews conducted for the Site. The following criteria are among those which will be considered to determine whether MNA continues to be the appropriate remedy to address groundwater contamination:

- Contaminant concentrations in groundwater at specified locations exhibit an increasing trend not originally predicted during remedy selection;
- Near-source wells exhibit large concentration increases indicative of a new or renewed release;
- Contaminants are identified in monitoring wells located outside of the original plume boundary;
- Contaminant concentrations are not decreasing at a sufficiently rapid rate to meet the remediation objectives; and
- Changes in land and/or groundwater use will adversely affect the protectiveness of the MNA remedy.

If EPA determines that MNA is no longer an appropriate remedy to effectively achieve groundwater RAOs, a contingent remedy involving the extraction and treatment of groundwater will be designed and implemented.

If EPA determines in the future that active groundwater extraction and treatment are necessary, it is estimated that contaminated groundwater could be captured by a series of three extraction wells pumping at a combined rate of 75 gpm. It is likely that, should this contingency need to be implemented, extracted groundwater would be treated in a separate treatment plant using similar parameters as outlined in the Landfill Lobes portion of the remedy above. However, a cost/benefit analysis will be conducted as part of the remedial design for the Landfill Lobes portion of the remedy to consider the relative merits of designing that treatment plant to handle potential future flows from the FDDA and DGGW. For purposes of estimating costs, only the monitored natural attenuation remedy for this area of the Site is included.

- *Institutional Controls*

The remedy will also include institutional controls to restrict the future use of groundwater until remedial goals are met. The type of institutional control(s) will be evaluated and selected during remedial design. See Institutional Controls section below for additional information.

- *Monitoring, Operation and Maintenance*

The remedy will include long-term monitoring of groundwater at least until RAOs are attained. Operation and maintenance activities would also be required should the contingent remedy be implemented.

The DGGW portion of the remedy will achieve RAOs by utilizing MNA processes to address groundwater contamination. If monitoring criteria determine that MNA is not adequate, active groundwater remediation will be implemented.

The cost of the DGGW portion of the remedy is $1.75 million.

The estimated additional cost to implement the active groundwater contingency for the DGGW is $2.5 million.

The total estimated cost of the Sutton Brook Disposal Area remedy is $29.98 million. As discussed earlier, the cost of the active groundwater contingencies are FDDA - $ 4.5 million, and DGGW - $2.5 million, for a total of $7 million. If both contingencies are implemented, the total estimated cost of the Sutton Brook Disposal Area remedy is $36.98 million.

The selected remedy may change somewhat as a result of the remedial design and construction processes. Changes to the remedy described in this Record of Decision, if any, will be documented in an Explanation of Significant Differences, or a Record of Decision Amendment, as appropriate.

Institutional Controls

In order to protect human health by controlling potential exposures to contaminated soils, sediments, and groundwater, the selected remedy relies on the use of Institutional Controls such as limitations on land and groundwater uses and activities. Institutional Controls are also necessary for the protection of the selected remedy. The details of the institutional controls will be resolved during the pre-design and remedial design phase in coordination with the parties performing the remedial action, impacted landowners, and local officials. MassDEP's participation with the Institutional Controls will be in accordance with Commonwealth of Massachusetts policies, guidance and regulations.

Risks from exposure to contaminated groundwater will be controlled through the implementation of institutional controls. In areas where groundwater contamination exceeds cleanup levels, groundwater use restrictions will be required for drinking water, industrial process water, or other purposes, until groundwater cleanup levels are met. The institutional controls pertaining to groundwater will include a local Town ordinance and/or moratorium that would be put in place under and within 500 feet of the edge of the mapped groundwater plume, or a Grant of Environmental Restriction. Other institutional controls mechanisms may be required, including Notices of Activity and Use Limitations. Institutional Controls will also be required to ensure that any remedial components constructed as part of the selected remedy, such as the landfill caps, are not disturbed or otherwise compromised by any other use or activity. Those implementing the ICs would be responsible to work with the Towns and affected property owners to help put in place these restrictions.

Institutional controls on groundwater are expected to be temporary (with the exception of under the Landfill Lobes), until such time as groundwater cleanup goals are met. Therefore, as the areal extent of contamination in the aquifer decreases, the area impacted by these restrictions will also change (decrease). Therefore periodic re-evaluation of the area impacted the ICs will be performed and the restrictions may change accordingly.

Long-term Monitoring and Five-year Reviews

Long-term monitoring of groundwater, surface water, and sediments will be required in order to evaluate contaminant status and migration and performance of the selected remedy. Groundwater monitoring is included to ensure that the remedy, as constructed, is operating as intended and to evaluate the success of MNA processes and to evaluate the need for implementation of the contingency remedy. Details of the monitoring program will be further developed during design and the preparation of a long-term monitoring plan.

Since wastes will be left in place as part of the selected remedy, the NCP requires periodic reviews of the remedy. A comprehensive review will be conducted at least every five years to evaluate the protectiveness of the remedy. The purpose of this Five-year Review is to evaluate the implementation and performance of the remedy in order to determine if the remedy is or will be protective of human health and the environment. The Five-year Review will document recommendations and follow-up actions as necessary to ensure long-term protectiveness of the remedy or bring about protectiveness of a remedy that is not protective. These recommendations could include providing additional response actions, improving O&M activities, optimizing the remedy, enforcing access controls and institutional controls and conducting additional studies and investigations.

The selected remedy also includes long-term operation, inspections, and maintenance of any systems put in place as part of the remedy, including the landfill caps, landfill gas and leachate collection systems, and systems to intercept, collect and treat contaminated groundwater. Long-term inspections and monitoring will also be required to ensure that institutional controls remain effective and are being enforced, and, long-term monitoring of groundwater, surface water, sediments and biota will be necessary to evaluate the effectiveness and re-colonization of biota in excavated areas of Sutton Brook, as well as the effectiveness of any revegetation, wetland restoration, or wetland replication area.

3. Summary of the Estimated Remedy Costs

Landfill Lobes

LF-2b: Containment of waste, vent landfill gas, restoration of wetlands and brook, partial containment of groundwater with a vertical barrier and groundwater remediation

CAPITAL COSTS	LF-2b
Construction Activities	
Pilot and Pump Test	$50,000
Site Prep	$90,000
Site Work	$44,800
LF Containment	$10,161,000
Sediment Excavation/ Brook Restoration	$1,046,620
Groundwater Containment	$1,785,000
In-situ groundwater remediation - MNA	$51,000
Groundwater extraction and ex-situ treatment	$1,582,000
Institutional Controls	$50,000
SUBTOTAL - CONSTRUCTION ACTIVITIES	$14,910,420
Contingency (10%)	$1,491,100
TOTAL CONSTRUCTION ACTIVITIES	$16,401,520
Professional/ Technical Services	
Project Management	$820,100
Remedial Design	

	$984,100
Construction Management	$984,100
Health and Safety	$246,100
Permitting/ Legal	$246,100
TOTAL PROFESSIONAL/ TECHNICAL SERVICES	**$3,280,500**
TOTAL CAPITAL COSTS	**$19,682,020**

ANNUAL OPERATION, MAINTENANCE AND MONITORING COSTS

LF-2b - GROUNDWATER MONITORING - 3 YEARS, GROUNDWATER EXTRACTION, TREATMENT AND MONITORING - 27 YEARS	$5,353,000
TOTAL - PRESENT VALUE - O&M COSTS	**$5,353,000**

PERIODIC COSTS - PRESENT VALUE (7%)

Five Year Site Reviews		$43,000
Groundwater Performance and Optimization Study		$11,000
Remedial Action Report		$21,000
Demobilization of on-site treatment system		$20,000
Well Abandonment		$13,000
Update Institutional Controls Plan		$7,000
TOTAL PRESENT VALUE PERIODIC COSTS	**$115,000**	

TOTAL PRESENT VALUE	**$25,150,020**
	LF-2b

Former Drum Disposal Area

FDDA-4: Excavation, treatment and/or disposal of soils with groundwater remediation (focused mass reduction)

CAPITAL COSTS			
Construction Activities			
Perform groundwater pilot test, data analysis	$50,000	-	
Site Prep	$52,500	-	
Site Work	$6,300	-	
Soil Excavation	$333,300	-	
In-situ groundwater treatment - MNA	$38,000		
On-site Disposal	$222,500	-	
Groundwater Containment Extraction and Treatment System	$ -	-	
Institutional Controls	$20,000	-	
SUBTOTAL - CONSTRUCTION ACTIVITIES	$722,600	-	
Contingency (10%)	$72,300	-	
TOTAL CONSTRUCTION ACTIVITIES	$794,900	-	
Profesional/ Technical Services			
Project Management	$47,700	-	$ -
Remedial Design	$95,400	-	$ -
Construction Management	$63,600	-	$ -
Health and Safety	$23,900	-	$ -
Permitting/ Legal	$23,900	-	$ -
TOTAL PROFESSIONAL/ TECHNICAL SERVICES	$254,500	-	$ -
TOTAL CAPITAL COSTS	**$1,049,400**	-	$ -

ANNUAL OPERATION, MAINTENANCE AND MONITORING COSTS		
MNA - 30 YEARS	$1,706,000	
TOTAL - PRESENT VALUE - MNA COSTS	$1,706,000	- $ - -
TOTAL - PRESENT VALUE - O&M COSTS	**$1,706,000**	- $ - -

PERIODIC COSTS - PRESENT VALUE (7%)	
Five Year Site Reviews	$43,000
Groundwater Performance and Optimization Study	$11,000
Remedial Action Report	$21,000
Demobilization of on-site treatment system	$20,000
Well Abandonment	$13,000
Update Institutional Controls Plan	$3,000
TOTAL PRESENT VALUE PERIODIC COSTS	$111,000
TOTAL PRESENT VALUE	**$2,866,400**

The estimated additional cost to implement the active groundwater contingency for the FDDA is $4.5 million.

Garage and Storage Area

GSA-2: Excavation and on-site disposal of soils

CAPITAL COSTS	
Construction Activities	
Pre-implementation Monitoring, Sampling, Testing and Analysis	$22,400
Mobilization/Demobilization	$30,000
Site Prep	$2,600
Soil Excavation	$52,000
On-site Disposal	$13,300
Institutional Controls	$ -
SUBTOTAL - CONSTRUCTION ACTIVITIES - ON-SITE DISPOSAL	$120,300
Contingency (10%)	$12,100
TOTAL CONSTRUCTION ACTIVITIES	$132,400
Profesional/ Technical Services	
Project Management	$10,600
Remedial Design	$19,900
Construction Management	$13,300
Health and Safety	$4,000
Permitting/ Legal	$4,000
TOTAL PROFESSIONAL/ TECHNICAL SERVICES	$51,800
TOTAL CAPITAL COSTS	**$184,200**
ANNUAL OPERATION AND MAINTENANCE COSTS	
O&M SUBTOTAL:	$ -

Contingency (10%)	$ -
TOTAL - O&M COSTS (ANNUAL)	$ -
TOTAL - PRESENT VALUE	$ -

PERIODIC COSTS - PRESENT VALUE (7%)	
Five Year Site Reviews	$ -
Groundwater Performance and Optimization Study	$ -
Remedial Action Report	$16,000
Demobilization of on-site treatment system	$ -
Well Abandonment	$ -
Update Institutional Controls Plan	$ -
	$ -
TOTAL PRESENT VALUE - PERIODIC COSTS	$16,000
TOTAL PRESENT VALUE	**$200,200**

Note: Costs assume no treatment prior to on-site disposal.

Downgradient Groundwater Area

DGGW-2: In-situ Remediation *(Assumes 30 years of MNA)*

CAPITAL COSTS	
Construction Activities	
Mobilization/Demobilization	$42,500
In-situ groundwater treatment - MNA	$88,500
Institutional Controls	$20,000
SUBTOTAL - CONSTRUCTION ACTIVITIES	$151,000
Contingency (10%)	$ 15,100

TOTAL CONSTRUCTION ACTIVITIES	$166,100
Profesional/ Technical Services	
Project Management	$12,100
Remedial Design	$22,700
Construction Management	$15,100
Health and Safety	$4,600
Permitting/ Legal	$4,600
TOTAL PROFESSIONAL/ TECHNICAL SERVICES	$59,100
TOTAL CAPITAL COSTS	**$225,200**

ANNUAL OPERATION, MAINTENANCE AND MONITORING COSTS

Groundwater Treatment - MNA	$98,800
Annual site-wide inspection	$3,000
O&M SUBTOTAL:	$101,800
Contingency (10%)	$10,200
TOTAL - O&M COSTS (ANNUAL)	$112,000
TOTAL - PRESENT VALUE - 30 YEARS, 7%	$1,389,900 (30 YR)

PERIODIC COSTS - PRESENT VALUE (7%)

Five Year Site Reviews	$43,000
Groundwater Performance and Optimization Study	$38,000
Remedial Action Report	$26,000
Demobilization of on-site treatment system	$ -

Well Abandonment	$7,000
Update Institutional Controls Plan	$3,000
TOTAL PRESENT VALUE - PERIODIC COSTS	**$117,000**
TOTAL PRESENT VALUE	**$1,732,100**

The estimated additional cost to implement the active groundwater contingency for the DGGW is $2.5 million.

The information in this cost estimate summary table is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment. This is an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

4. Expected Outcomes of the Selected Remedy

The primary expected outcomes of the selected remedy are that: groundwater throughout the Site beyond the point of compliance (the edge of the Landfill Lobes) will no longer present an unacceptable risk to future residents or future facility workers via ingestion or inhalation and will be suitable for consumption; presumed risk from contact with landfill waste will be eliminated; ongoing impacts to groundwater from landfill waste, will be reduced or eliminated; the soils at the Site (Garage and Storage Area) will no longer present an unacceptable risk to future residents via direct contact and will be suitable for general use; and soils at the Site (Former Drum Disposal Area) will no longer be a source of groundwater contamination. Approximately 65-210 years are estimated as the amount of time necessary to achieve the goal of groundwater acceptable for human consumption, and 2-3 years are estimated as the amount of time necessary to achieve the soil goals at the Garage and Storage Area and the Former Drum Disposal Area. The selected remedy will also provide environmental and ecological benefits such as restoration of impacted brook sediments and surface water, and protection of terrestrial and aquatic wildlife.

a. Cleanup Levels

i. Ground Water Cleanup Levels

Cleanup levels have been established in groundwater for all chemicals of concern identified in the Baseline Risk Assessment found to pose an unacceptable risk to either public health or the environment. Cleanup levels have been set based on the ARARs (MCLs) as available, or other suitable criteria described below. Periodic assessments of the protection afforded by remedial actions will be made as the remedy is being implemented and at the completion of the remedial action. At the time that Ground Water Cleanup Levels identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment shall be performed on all residual groundwater contamination to determine whether the remedial action is protective. This risk assessment of the residual groundwater contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by all chemicals of concern (including but not limited to the chemicals of concern) via ingestion of groundwater and inhalation of VOCs from domestic water usage. If, after review of the risk assessment, the remedial action is not determined to be protective by EPA, the remedial action shall continue until either protective levels are achieved, and are not exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective or is modified. These protective residual levels shall constitute the final cleanup levels for this ROD and shall be considered performance standards for this remedial action.

Because the aquifer at and beyond the compliance boundary for the landfill is a Class IIB aquifer which is a potential source of drinking water, MCLs established under the Safe Drinking Water Act, are ARARs. The Massachusetts Department of Environmental Protection completed a Ground Water Use and Value Determination on the aquifer in which the Sutton Brook Disposal Area Site is located. This determination is attached as Appendix B. This finding indicates that the groundwater beneath the Site has medium use and value as a future drinking water supply because the aquifer is considered to be a potential source of drinking water, and there are several private well users in the area (private wells do not appear to have been impacted by the Site). Therefore, drinking water standards, consistent with the use and value determination, shall be required to be attained in the groundwater at the Site.

In the absence of an MCLG, an MCL, a proposed MCLG, proposed MCL, a more stringent State standard, or other suitable criteria to be considered (<u>i.e.</u>, health advisory, State guideline), a cleanup level was derived for each chemical of concern having carcinogenic potential (Classes A, B, and C compounds) based on a 10^{-6} excess cancer risk level per compound considering the future ingestion of ground water and inhalation of VOCs from domestic water usage. In the absence of the above standards and criteria, cleanup levels for all other chemicals of concern (Classes D and E) were established based on a level that represent an acceptable exposure level to which the human population including sensitive subgroups may be exposed without adverse affect during a lifetime or part of a lifetime, incorporating an adequate margin of safety (hazard quotient = 1) considering the future ingestion of groundwater and inhalation of VOCs from domestic water usage.

Table **L-1** summarizes the Cleanup Levels for carcinogenic and non-carcinogenic chemicals of concern identified in ground water.

All Groundwater Cleanup Levels identified in the ROD and newly promulgated ARARs and modified ARARs which call into question the protectiveness of the remedy and the protective levels determined as a consequence of the risk assessment of residual contamination, must be met at the completion of the remedial action at the points of compliance. At this Site, Groundwater Cleanup Levels must be met at the edge of and beyond the Landfill Lobes (this includes groundwater at the Former Drum Disposal Area, and the Downgradient Groundwater Area). EPA has estimated that the Cleanup levels will be obtained within 65 – 210 years after completion of the source control component.

After the cleanup levels have been met at the Former Drum Disposal Area, the Downgradient Groundwater Area, and at the downgradient edge of the Landfill Lobes, and the remedy is determined to be protective, the groundwater treatment system will be shut down. The groundwater monitoring system will be utilized to collect information quarterly for three additional years to ensure that the cleanup levels have been met and the remedy is protective.

ii. Soil Cleanup Levels

- Human Health Based Soil Cleanup Levels

Soil cleanup levels for compounds of concern in soils at the Garage and Storage Area exhibiting an unacceptable cancer risk have been have been established such that they are protective of human health. Soil cleanup levels for known and suspect carcinogenic chemicals of concern (Classes A, B, and C compounds) have been set at a 10^{-5} excess cancer risk level considering exposure of future residents (adult and young child) to upland soils (by ingestion and dermal contact) at the Garage and Storage Area. Exposure parameters for ingestion and dermal contact have been described in Section G. If a cleanup value described above is not capable of being detected with good precision and accuracy or is below background values, then either the practical quantitation limit or a background value was used as appropriate for the soil cleanup level.

Table **L-2** summarizes the cleanup levels for carcinogenic and non-carcinogenic chemicals of concern in soils protective of direct contact with soils.

These cleanup levels must be met at the completion of the remedial action at the Garage and Storage Area. These soil cleanup levels attain EPA's risk management goal for remedial actions and have been determined by EPA to be protective.

- Ecological Based Soil Cleanup Levels

Soil cleanup levels for chemicals of concern in soils at the Garage and Storage Area and the Former Drum Disposal Area exhibiting an unacceptable ecological risk, have been established such that they are protective of terrestrial wildlife. Exposure parameters and assumptions utilized to develop these cleanup levels have been described in Section G.

Table **L-3** summarizes the cleanup levels for ecological chemicals of concern in soils protective of terrestrial wildlife.

These cleanup levels must be met at the Garage and Storage Area and the Former Drum Disposal Area. These soil cleanup levels attain EPA's risk management goal for remedial actions and have been determined by EPA to be protective.

EPA also considered the potential for contaminants in soils at the FDDA to continue to be a source of groundwater contamination. Chemicals detected in both soils and groundwater were compared. The comparison showed that twenty-eight chemicals were found in both soils and groundwater. Of the chemicals found in both soils and groundwater, seventeen have SSLs (Soil Screening Levels, EPA 2002). Of these seventeen chemicals, arsenic, bis(2-Ethylhexyl)phthalate, ethylbenzene, toluene and xylenes exceed MCLs in groundwater. A soil cleanup level has not been set for arsenic, as arsenic soil exposures did not exceed EPAs risk range. Furthermore, arsenic in soils was detected at the FDDA at concentrations which are lower than the level that would be set to address the potential for leaching. For the other four organic chemicals (bis(2-Ethylhexyl)phthalate, ethylbenzene, toluene and xylenes), the soil cleanup levels which have been set to address ecological risk will also be protective of potential leaching to groundwater.

iii. Surface Water Cleanup Levels

Cleanup levels for chemicals of concern in surface water between the landfill lobes exhibiting an unacceptable ecological risk, have been established such that they are protective of aquatic life. Exposure parameters and assumptions utilized to develop these cleanup levels have been described in Section G.

Table **L-4** summarizes the cleanup levels for ecological chemicals of concern in surface water protective of aquatic life.

These cleanup levels must be met at the completion of the remedial action at within Sutton Brook. These surface water cleanup levels attain EPA's risk management goal for remedial actions and have been determined by EPA to be protective.

iv. Sediment Cleanup Levels

Cleanup levels for chemicals of concern in sediments between the landfill lobes exhibiting an unacceptable ecological risk, have been established such that they are protective of aquatic life. Exposure parameters and assumptions utilized to develop these cleanup levels have been described in Section G.

Table **L-5** summarizes the cleanup levels for ecological chemicals of concern in sediments protective of aquatic life.

These cleanup levels must be met at the completion of the remedial action within the Sutton Brook channel. These sediment cleanup levels attain EPA's risk management goal for remedial actions and have been determined by EPA to be protective.

These soil, surface water and sediment cleanup levels must be met at the completion of the remedial action at the points of compliance. They are consistent with ARARs for soils, surface water and sediments, attain EPA's risk management goals for remedial action, and are protective of human health or the environment.

M. STATUTORY DETERMINATIONS

The remedial action selected for implementation at the Sutton Brook Disposal Area Site is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, will comply with ARARs and is cost effective. In addition, the selected remedy utilizes permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable, and satisfies the statutory preference for treatment that permanently and significantly reduces the mobility, toxicity or volume of hazardous substances as a principal element.

1. The Selected Remedy is Protective of Human Health and the Environment

The remedy at this Site will adequately protect human health and the environment by eliminating, reducing or controlling exposures to human and environmental receptors through treatment, engineering controls and institutional controls. More specifically:

At the Landfill Lobes: the cap will prevent direct contact with the waste and infiltration of contaminants to groundwater; the vertical barrier will prevent recontamination of Sutton Brook by controlling migration of contaminated groundwater; active treatment of groundwater and MNA will help restore the aquifer; institutional controls will protect the remedy and prevent use of contaminated groundwater; and excavation/restoration of wetlands will eliminate risk to wildlife receptors.

At the Former Drum Disposal Area: Excavation of soils will remove an ongoing source of groundwater contamination and will eliminate risk from soil exposure to terrestrial wildlife; and remediation of groundwater will eliminate potential exposure to a future resident via ingestion or inhalation, and will help to restore the aquifer.

At the Garage and Storage Area: Excavation of soils will eliminate exposure via direct contact to a future resident and exposure to terrestrial wildlife.

At the Downgradient Groundwater Area: Remediation of groundwater will help to restore the aquifer; and institutional controls will prevent use of contaminated groundwater prior to achievement of cleanup levels.

The selected remedy will reduce potential human health risk levels such that they do not exceed EPA's acceptable risk range of 10^{-4} to 10^{-6} for incremental carcinogenic risk and such that the non-carcinogenic hazard is below a level of concern. It will reduce potential human health risk levels to protective ARARs levels, i.e., the remedy will comply with ARARs and To Be Considered criteria. The remedy provides adequate protection of the environment by addressing risks to terrestrial wildlife in upland soils (FDDA and GSA) and by addressing risks to aquatic life in surface water and sediments (Sutton Brook between the landfill lobes). Implementation of the selected remedy will not pose any unacceptable short-term risks or cause any cross-media impacts.

At the time that the ARAR based Ground Water Cleanup Levels identified in the ROD and newly promulgated ARARs and modified ARARs that call into question the protectiveness of the remedy have been achieved and have not been exceeded for a period of three consecutive years, a risk assessment shall be performed on the residual ground water contamination to determine whether the remedy is protective. This risk assessment of the residual ground water contamination shall follow EPA procedures and will assess the cumulative carcinogenic and non-carcinogenic risks posed by ingestion of ground water and inhalation of VOCs from domestic water usage. If, after review of the risk assessment, the remedy is not determined to be protective by EPA, the remedial action shall continue until protective levels are achieved and have not been exceeded for a period of three consecutive years, or until the remedy is otherwise deemed protective. These protective residual levels shall constitute the final cleanup levels for this Record of Decision and shall be considered performance standards for any remedial action.

2. The Selected Remedy Complies With ARARs

The selected remedy will comply with all Federal and any more stringent State ARARs that pertain to the Site. See the tables in Appendix D for a list of all ARARs and To Be Considered requirements for the selected remedy. In addition, since wastes (i.e., contaminated soils from the FDDA and GSA and sediments from Sutton Brook between the Landfill Lobes) will be moved within the same "area of contamination" (AOC) to be consolidated with the Landfill Lobes prior to the construction of the landfill cap, Land Disposal Restrictions (LDRs) do not apply.

3. The Selected Remedy is Cost-Effective

In the EPA's judgment, the selected remedy is cost-effective because the remedy's costs are proportional to its overall effectiveness (see 40 CFR 300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria (i.e., that are protective of human health and the environment and comply with all Federal and any more stringent State ARARs, or as appropriate, waive ARARs). Overall effectiveness was evaluated by assessing three of the five balancing criteria -- long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness, in combination. The overall effectiveness of each alternative then was compared to the alternative's costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

For the Landfill Lobes, EPA has determined that the selected remedy, alternative LF-2b, is cost-effective as it meets both threshold criteria and is reasonable given the relationship between the overall effectiveness afforded by the other alternatives and cost compared to the other alternatives. The available alternatives are closely comparable with regard to both the long-term effectiveness and permanence criterion and the short-term effectiveness criterion. With regard to the reduction of toxicity, mobility and volume through treatment, alternative LF-2a, does not satisfy this criterion unless the contingency for groundwater treatment is triggered. Alternatives LF-3 and LF-4 both contain groundwater treatment as a component and satisfy this criterion, but at significant incremental cost ($6.2 million and $15.7 million respectively) above the cost of LF-2b (which also satisfies the reduction of toxicity, mobility and volume through treatment criteria), without providing commensurate incremental benefit. Although modeling does not clearly show a shorter cleanup timeframe associated with LF-2b over LF-2a, the installation of the vertical barrier will serve to concentrate the discharge of all of the contaminated groundwater from the Southern Lobe at its western edge (where only a limited amount of groundwater currently discharges). The vertical barrier also prevents the contaminated groundwater plume from discharging directly to Sutton Brook. The concentration of contaminated groundwater at the western edge of the Southern Lobe, justifies active groundwater treatment at that location.

For the Former Drum Disposal Area, EPA has determined that the selected remedy, alternative FDDA-4, is cost effective as it meets both threshold criteria and is reasonable given the relationship between the overall effectiveness afforded by the other alternatives and cost compared to the other alternatives. The available alternatives are closely comparable for the most part with regard to both the long-term effectiveness and permanence criterion and the short-term effectiveness criterion, with FDDA-2 having slightly less long-term effectiveness as capped contaminated soils may have the potential to leach to groundwater. With regard to the reduction of toxicity, mobility and volume through treatment, alternatives FDDA-2, FDDA-3 and FDDA-5 satisfy this criterion, while alternative FDDA-4 does not satisfy this criterion unless the contingency for groundwater treatment is triggered. However, the incremental cost associated with achieving this criteria and the relative incremental benefit is not justifiable. At an estimated increased cost of $4.7 or $4.8 million, it is estimated that groundwater associated with the FDDA will at best achieve cleanup goals 6-12 years faster than under FDDA-4 (24-30 years estimated, versus 36 years estimated). In addition, the Former Drum Disposal Area is upgradient of the Downgradient Groundwater Area. The shortest estimate for attaining groundwater cleanup levels at the Downgradient Groundwater Area, is 57 years. Therefore, the added cost of $4.7-$4.8 million is not warranted, and FDDA-4 is determined to be cost effective.

For the Garage and Storage Area, EPA has determined that the selected remedy, alternative GSA-2, is cost effective as it satisfies both threshold criteria and is reasonable given its overall cost and effectiveness. It is the only GSA alternative which satisfies both threshold criteria.

For the Downgradient Groundwater Area, EPA has determined that the selected remedy, alternative DGGW-2, is cost effective as it satisfies both threshold criteria and is reasonable given the relationship between the overall effectiveness afforded by the other alternatives and cost compared to the other alternatives. The available alternatives are closely comparable for the most part with regard to both the long-term effectiveness and permanence criterion and the short-term effectiveness criterion, with DGGW-2 having greater short-term effectiveness due to less wetlands impacts from installation of components of the treatment system. With regard to the reduction of toxicity, mobility and volume through treatment, alternatives DGGW-3 and DGW-4 satisfy this criterion, while alternative DGGW-2 does not satisfy this criterion unless the contingency for groundwater treatment is triggered. However, the incremental cost to satisfy this criterion is $8 million. The benefit received for the $8 million increased cost, is that it is estimated that groundwater cleanup levels will be achieved in as few as 57 years, rather than as few as 67 years (the alternative DGGW-2 estimate). The incremental benefit realized by the added cost is not balanced by a comparable incremental benefit in overall effectiveness. Alternative DGGW-2 is considered to be cost effective as it provides the best balance of cost and overall effectiveness.

4. The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

Once the Agency identified those alternatives that attain or, as appropriate, waive ARARs and that are protective of human health and the environment, EPA identified which alternative utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. This determination was made by deciding which one of the identified alternatives provides the best balance of trade-offs among alternatives in terms of: 1) long-term effectiveness and permanence; 2) reduction of toxicity, mobility or volume through treatment; 3) short-term effectiveness; 4) implementability; and 5) cost. The balancing test emphasized long-term effectiveness and permanence and the reduction of toxicity, mobility and volume through treatment; and considered the preference for treatment as a principal element, the bias against off-site land disposal of untreated waste, and community and State acceptance. The selected remedy provides the best balance of trade-offs among the alternatives.

For the Landfill Lobes, the selected remedy and the other available alternatives are closely comparable with regard to the long-term effectiveness and permanence criterion, and the short-term effectiveness criterion. The selected remedy includes reduction of toxicity, mobility and volume through treatment of groundwater at the Southern Lobe, providing additional benefit without additional, unwarranted cost.

For the Former Drum Disposal Area, the selected remedy and the other available alternatives are closely comparable for the most part with regard to both long-term effectiveness and permanence, and short-term effectiveness, with FDDA-2 having slightly less long-term effectiveness. The selected remedy will utilize treatment of groundwater if treatment actions are triggered. All available alternatives are similar with regard to implementability. The selected remedy provides the best balance of the tradeoffs among the alternatives

For the Garage and Storage Area, the selected remedy is the only alternative that is protective of human health and the environment, attains ARARs, and achieves remedial objectives quickly and cost effectively.

For the Downgradient Groundwater Area, the selected remedy and the other available alternatives are closely comparable for the most part with regard to both long-term effectiveness and permanence, and short-term effectiveness, with DGGW-2 having greater short-term effectiveness due to less wetlands impacts from installation of components of the treatment system. The selected remedy will utilize treatment of groundwater if treatment actions are triggered. All available alternatives are readily implementable. With regard to cost, very little benefit is gained by significant incremental increases in cost. The selected remedy provides the best balance of the tradeoffs among the alternatives.

5. The Selected Remedy Satisfies the Preference for Treatment Which Permanently and Significantly Reduces the Toxicity, Mobility or Volume of the Hazardous Substances as a Principal Element

The principal elements of the selected remedy are:

-Excavation of contaminated soils exceeding site-specific cleanup levels from the Former Drum Disposal Area (FDDA) and the former Garage and Storage Area (GSA);

-Excavation of contaminated soils and sediments exceeding site-specific cleanup levels from a portion of Sutton Brook between the two landfill lobes;
-Consolidation of excavated soils and sediments along with other debris adjacent to the landfills into the landfills;
-Construction of a low permeability cap over both landfill lobes, including systems to collect and manage gases and storm water from the landfills;
-Construction of a vertical barrier to intercept groundwater from the southern landfill lobe to prevent it from entering Sutton Brook;
-Collection and treatment of contaminated groundwater from an area west of the southern landfill lobe;
-Monitored natural attenuation of areas of groundwater contamination not captured by the extraction system, with a contingency to expand the area of active groundwater remediation, if necessary;
-Institutional controls such as deed restrictions and/or local ordinances to prevent unacceptable exposures to wastes left in place and to restrict exposure to contaminated groundwater until cleanup levels are met;
-Long-term groundwater, surface water, and sediment monitoring, and periodic five-year reviews of the remedy.

The selected remedy satisfies the statutory preference for treatment as a principal element by treating contaminated groundwater. As described earlier, if triggered the scope of groundwater treatment will be expanded.

6. Five-Year Reviews of the Selected Remedy are Required

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within five years after initiation of the remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

N. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA presented a proposed plan for remediation of the Site on June 27, 2007.
The major components of the preferred alternative include the following:

- Excavation of contaminated soils exceeding site-specific cleanup levels from the Former Drum Disposal Area (FDDA) and the former Garage and Storage Area (GSA);
- Excavation of contaminated soils and sediments exceeding site-specific cleanup levels from a portion of Sutton Brook between the two landfill lobes;
- Consolidation of excavated soils and sediments along with other debris adjacent to the landfills into the landfills;

- Construction of a low permeability cap over both landfill lobes, including systems to collect and manage gases and storm water from the landfills;
- Construction of a vertical barrier to intercept groundwater from the southern landfill lobe to prevent it from entering Sutton Brook;
- Collection and treatment of contaminated groundwater from an area west of the southern landfill lobe;
- Monitored natural attenuation of areas of groundwater contamination not captured by the extraction system, with a contingency to expand the area of active groundwater remediation, if necessary;
- Institutional controls such as deed restrictions and/or local ordinances to prevent unacceptable exposures to wastes left in place and to restrict exposure to contaminated groundwater until cleanup levels are met;
- Long-term groundwater, surface water, and sediment monitoring, and periodic five-year reviews of the remedy.

EPA reviewed all written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the proposed plan, were necessary.

O. STATE ROLE

The Massachusetts Department of Environmental Protection (MassDEP), as representative for the Commonwealth of Massachusetts, has reviewed the various alternatives and has indicated its support for the selected remedy. The MassDEP has also reviewed the Remedial Investigation, Risk Assessment and Feasibility Study to determine if the selected remedy is in compliance with applicable or relevant and appropriate State environmental and facility siting laws and regulations. MassDEP, as representative for the Commonwealth of Massachusetts, concurs with the selected remedy for the Sutton Brook Disposal Area Site. A copy of the declaration of concurrence is attached as Appendix A.

PART 3: THE RESPONSIVENESS SUMMARY

There has been extensive community participation during the Remedial Investigation/Feasibility Study process for the Sutton Brook Disposal Area Superfund Site. A more detailed summary of community coordination and involvement is outlined in Section C of Part 2 of the ROD, Community Participation.

EPA published a notice of availability of the Proposed Plan and Administrative Record in the Lowell Sun on June 15, 2007 and released its Proposed Plan to the public on June 27, 2007. EPA also held a public information session on June 27, 2007 at the Tewksbury Town Library in Tewksbury, Massachusetts, and a Public Hearing on July 18, 2007, also at the Town Library. Transcripts were created for both meetings and have been made part of the Administrative Record for this Record of Decision. In addition to the oral comments, a number of written comments were provided on the Proposed Plan. The full text of all written and oral comments received during the comment period has been included in the Administrative Record.

Outlined below is a summary of significant comments received from the public and other interested parties during the public comment period and EPA's response to those comments. Similar comments have been summarized and grouped together, and technical and legal issues have been divided into a number of general categories. These general categories are summarized as follows:

A. Questions and Comments Regarding Consolidation of Soils from Other Areas and Capping of the Landfill Lobes
B. Questions and Comments Regarding the Approach to Groundwater Cleanup
C. Questions and Comments Regarding the Scope of the Remedial Investigation and Feasibility Study (RI/FS)
D. Questions and Comments Regarding Liability, Enforcement, and the Timetable for Remedy Implementation

A. <u>Questions and Comments Regarding Consolidation of Soils from Other Areas and Capping of the Landfill Lobes:</u>

A.1. Several commenters expressed concern about the volume of capping materials that would be required to be brought to the Site under the Preferred Alternative, citing concerns about public safety, road deterioration, noise, dust, and air emissions. Many of these same commenters asked EPA to explore trucking routes that minimized disturbance to the residential community near the Site.

<u>EPA Response:</u>

EPA acknowledges that a significant volume of material will need to be transported to the

Site in order to construct the remedy. At present, South Street is the only route available for trucks to access the Site. As planning for the remedy progresses, and at the time that the remedy is implemented, EPA will work with the local community (including the police department, fire department, and school department), the construction contractor(s) that will be transporting materials, and the Potentially Responsible Parties (PRPs), to agree on a route or routes to access the Site, as well as to address other transportation issues (such as time of operations and locations of special concern) that may be identified.

A.2 Several questions were raised regarding the appropriate design for the landfill caps and the regulatory requirements should be considered Applicable or Relevant and Appropriate Requirements (ARARs) that would govern such design (i.e., RCRA Subtitle C hazardous waste regulations or state solid waste regulations).

EPA Response:

EPA has determined that RCRA Subtitle C hazardous waste regulations are applicable at the Site, and, as ARARs, they govern the landfill's closure/capping requirements. Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, which included disposal after 1980, the cap design and construction shall meet RCRA Subtitle C hazardous waste standards. Notwithstanding the applicability of these RCRA Subtitle C ARARs, there is flexibility in the design of the cover to meet the Subtitle C performance standards. The details of cap materials and construction will be finalized during remedial design.

The comment letter from the PRP group also contained data comparing groundwater contaminant levels at the Northern Lobe with groundwater monitoring data from a set of solid waste landfills. The comment argues that the data are comparable and justify selecting a solid waste cap for the Northern Lobe. As described above, EPA made its determination based on the evidence of hazardous waste disposal at the Site. The comparison of groundwater monitoring data is not germane in determining the applicability of the RCRA Subtitle C hazardous waste regulations.

A.3 One commenter noted that EPA should require that materials consolidated from other areas into the landfill lobes be placed above the water table to avoid contact with groundwater and to ensure that these materials do not serve as an ongoing source of groundwater contamination.

EPA Response:

EPA agrees with the comment. Consolidated material will be placed above the water table.

A.4 One commenter requested that the landfill be designed so that future use is possible.

EPA Response:

Reuse of previously contaminated properties is a goal of EPA. At this Site, the volume of waste material contained in the landfill lobes, the limited extent of upland area on Site, the proximity of wetlands to the lobes and the access road along the northern lobe, all serve to place limitations on reuse possibilities (See Figure E-2). The wetlands and the access road, essentially eliminate the possibility of flattening out the Northern Lobe which would be necessary for something like athletic fields, and would also require expanding the footprint of the Northern Lobe. In addition, regulations exist requiring that impacts to wetlands and wetland loss be avoided to the extent practicable. There is a possibility of incorporating future use into the landfill lobe design, although any use would need to be compatible with preserving the protectiveness of the remedy and would need to be incorporated into the remedial design process.

A.5 Citing implementability and flooding concerns, one commenter expressed strong opposition to alternative LF-4, which evaluated re-routing of Sutton Brook around the landfill lobes.

EPA Response:

EPA agrees that alternative LF-4 is not the best choice for addressing risks associated with the landfill lobes. As documented in the Feasibility Study as well as earlier in this Record of Decision, when comparing the various alternatives against the required "nine-criteria," alternative LF-4 is not, on balance, the strongest alternative. The most significant issues which weigh against alternative LF-4 are the extensive wetland impacts that would result in order to implement the alternative. As a result, EPA has determined that LF-4 fails to meet location specific ARARs.

B. Questions and Comments Regarding the Approach to Groundwater Cleanup:

B.1. The Massachusetts Department of Environmental Protection (MassDEP) as well as the community group, TOXIC, Inc. commented in support of EPA's proposal for groundwater treatment in the area of the landfill's Southern Lobe. Another commenter asked for more information on the rationale for groundwater treatment at the Southern Lobe but not the Northern Lobe.

EPA Response:

As stated elsewhere, EPA has determined that active groundwater treatment at the western edge of the Southern Lobe is warranted due to the high level of groundwater contamination at the Southern Lobe. Active groundwater treatment is further warranted due to the concentrating and focusing of contaminated groundwater at the western edge of the Southern Lobe, which will occur when the vertical barrier is installed as part of the remedy. The vertical barrier will prevent the migration of highly contaminated groundwater to Sutton Brook, and will direct contaminated groundwater at the Southern Lobe in a westerly direction to the "Area for Focused Groundwater Treatment" (see Figure L-1), where active groundwater treatment will occur. The driving factor in EPA not requiring active groundwater treatment at the Northern Lobe is that, while groundwater from the Northern Lobe is contaminated, it is contaminated at significantly lower concentrations when compared to groundwater at the Southern Lobe (a high concentration of 842 parts per billion of total VOCs at the Northern Lobe, and a high concentration of 57,210 parts per billion of total VOCs at the Southern Lobe). EPA has determined that the natural attenuation which is presently occurring, coupled with the capping of the Northern Lobe, will adequately address the groundwater contamination associated with the Northern Lobe. It should be noted, that in general, groundwater from the Northern Lobe flows through the FDDA and the DGGW areas. Because of this, if the groundwater contingency were to be implemented at either the FDDA or the DGGW, groundwater which had originated at the Northern Lobe would be addressed (whether it needed to be, or not).

B.2 One commenter requested clarification of the duration of the planned groundwater remediation at the Southern Lobe and whether EPA planned to establish criteria for shutting down such treatment in the future.

EPA Response:

As described in this Record of Decision, active groundwater treatment will be initiated after implementation of the source control portions of the remedy (capping and vertical barrier) at the Southern Lobe. The reason for starting groundwater treatment after the cap and vertical barrier have been constructed is that it is expected that groundwater dynamics (flow direction, flow rates, groundwater elevation, etc.) will be affected by these source control measures. The active groundwater treatment will be most effective if it can account for the then-current groundwater conditions.

As described in the Record of Decision, groundwater treatment will continue until cleanup levels have been met at the edge of the Southern Lobe. After cleanup levels have been met, which is estimated to occur in 65 years to 210 years, the groundwater at the edge of the Southern Lobe will continue to be monitored for three additional years to ensure that the cleanup levels continue to be met and the remedy is protective. Since wastes will be left in place as part of the selected remedy, the NCP requires periodic reviews of the remedy. A comprehensive review will be conducted at least every five years to evaluate the protectiveness of the remedy.

B.3. Comments on behalf of the PRPs who performed the RI/FS were provided arguing for delayed implementation of any active groundwater treatment and supporting monitored natural attenuation (MNA) as the remedy for the Southern Lobe area.

EPA Response:

EPA has determined that it is appropriate to implement active groundwater treatment at the Southern Lobe following completion of the construction of the landfill cap and the vertical barrier. EPA does not agree that a delay is warranted. Currently, high concentrations of contaminants in groundwater exist at the "Area for Focused Groundwater Treatment" along the western edge of the Southern Lobe (See Figure L-1). Following construction of the vertical barrier, virtually all contaminated groundwater associated with the Southern Lobe will migrate through the "Area for Focused Groundwater Treatment," rather than the majority of it discharging directly to Sutton Brook as currently occurs. This is necessary to prevent contaminated groundwater from continuing to contaminate surface water and sediment within Sutton Brook. This will significantly add to the overall contaminant load at the "Area for Focused Groundwater Treatment". Because of these issues (current high contaminant levels and expected additional contaminant load), EPA has determined that MNA will not be adequate in this area and that it is appropriate to start active groundwater treatment following implementation of the source control measures (cap and vertical barrier) at the Southern Lobe. As described in Section L., the selected remedy calls for pre-design studies to identify the precise combination of remedial processes necessary to treat groundwater.

B.4. Comments on behalf of the community group, TOXIC, Inc., questioned the appropriateness of selecting MNA as a component of the groundwater remedy.

EPA Response:

EPA has determined that the Remedial Investigation supports the conclusion that MNA is currently occurring within groundwater at the Site. MNA, along with the mostly horizontal flow of groundwater, the general absence of contaminant migration to bedrock and overall slow groundwater movement, are helping to limit the spread of the contaminated groundwater plume. EPA has determined that the source control measures to be implemented as part of the remedy (including the excavation of contaminated soils and sediments and the installation of the landfill cover) will eliminate or reduce ongoing sources of contamination and will serve to support the success of MNA. However, as stated in this ROD, if MNA is determined to be not effective, the remedy contains a contingency whereby active groundwater treatment will be implemented.

B.5. A number of commenters requested that the ROD explain the process and triggers for moving to active remediation for areas where MNA is selected as a remedy with a contingency for future treatment. Many of these comments also expressed concern about the timing of the first such evaluation (which EPA proposed to be conducted during the first Five-Year Review).

EPA Response:

Section L of this Record of Decision discusses the remedy, including the triggers for potentially changing from MNA to active groundwater remediation. Briefly, groundwater will be monitored for indicators to demonstrate that conditions remain that are conducive to MNA, as well as to demonstrate that MNA is, in fact, occurring, and that MNA is effective in addressing groundwater contamination at the Site.

The following criteria are among those which will be considered to determine whether MNA continues to be the appropriate remedy to address groundwater contamination:

- Contaminant concentrations in groundwater at specified locations exhibit an increasing trend not originally predicted during remedy selection;
- Near-source wells exhibit large concentration increases indicative of a new or renewed release;
- Contaminants are identified in monitoring wells located outside of the original plume boundary;
- Contaminant concentrations are not decreasing at a sufficiently rapid rate to meet the remediation objectives; and
- Changes in land and/or groundwater use will adversely affect the protectiveness of the MNA remedy.

If EPA determines that MNA will not meet Remedial Action Objectives, active groundwater treatment will be required. The Remedial Design/Remedial Action Scope of Work (RD/RA SOW), which will govern the implementation of the design and construction of the remedy, will detail the timing and technical and design steps required in order to implement active groundwater treatment.

Part 2 of the Record of Decision states that "EPA will evaluate the progress of the MNA portion of the remedy toward achieving RAOs as data become available, but no less frequently than during the 5-Year Reviews conducted for the Site." EPA is required to conduct 5-Year Reviews at the Sutton Brook Disposal Area Site, at a minimum, every 5 years after the commencement of the Remedial Action, which is defined as when the Remedial Design is completed. As the source control activities are expected to take 2 – 3 years to implement, EPA expects that at most there will be 2-3 years of monitoring data at the time of the first 5-Year Review. Given that the source control activities are expected to impact groundwater elevation, flow direction and rate, as well as contaminant load, EPA has determined that an estimated 2-3 year period between the completion of the source control activities (capping and soil excavation) and the initiation of the first 5-Year Review evaluation is not excessive.

B.6. Comments on behalf of the community group, TOXIC, Inc., requested clarification on the type of vertical barrier proposed for the Southern Lobe, stressing opposition to a "hanging barrier," which might allow groundwater to flow under the barrier.

EPA Response:

In order to prevent migration of contaminated groundwater under the vertical barrier, the base of the barrier will be "tied-in" to an impermeable or low-permeability layer (e.g., till or bedrock). This requirement is noted in Section L in Part 2 of this ROD.

B.7. Comments on behalf of the community group, TOXIC, Inc., expressed support for alternatives FDDA-3 and DGGW-3, rather than EPA's preferred alternatives for those areas.

EPA Response:

Alternatives FDDA-3 and DGGW-3 each has active groundwater treatment as a component. EPA has determined that the source control actions that will be taken at the Site (including landfill cover, vertical barrier, and source removal) will be effective and will, in combination with MNA, meet site objectives. EPA has determined that the added estimated expense of FDDA-3 (approximately $4.8 million) and DGGW-3 (approximately $7 million) is not justified given that the gains predicted for the amount of time to achieve cleanup levels under FDDA-3 and DGGW-3 are modest. As stated and described earlier, if EPA determines that MNA is not effective in addressing groundwater contamination, the remedy has a contingency whereby active groundwater treatment would be implemented at the Former Drum Disposal Area, the Downgradient Groundwater Area, or both areas.

B.8. Comments on behalf of the Massachusetts Bay Transportation Authority (MBTA) suggested that the groundwater at the Site be re-classified as a non-potential drinking water supply and that the remedy should not be based on restoration to drinking water standards.

EPA Response:

Consistent with EPA's 1995 Final Ground Water Use and Value Determination Guidance, the MassDEP completed a "Groundwater Use and Value Determination" in July 2001, for groundwater at and in the vicinity of the Sutton Brook Disposal Area Site. The purpose of the Use and Value Determination is to identify whether the aquifer at the

Site should be considered of "High," "Medium," or "Low" use and value. In the development of this Determination, MassDEP applied the criteria for groundwater classification as promulgated in the Massachusetts Contingency Plan (MCP). The classification contained in the MCP considers criteria similar to those recommended in the EPA Use and Value Guidance. MassDEP's recommendation supports a Medium Use and Value for the groundwater underlying the Site. Evaluation criteria utilized in the Use and Value Determination for the Sutton Brook Disposal Area support the classification of the aquifer as a potential drinking water supply. As such, potential use of the aquifer as a drinking water supply must be considered by EPA in setting cleanup levels and in choosing a remedy.

The Groundwater Use and Value Determination can be found in Appendix B.

B.9. One commenter requested further details on the rationale for MNA in some areas and collection and treatment in other areas, as well as an explanation of where long-term monitoring would be conducted.

EPA Response:

EPA has determined that active groundwater treatment at the western edge of the Southern Lobe is warranted due to the high level of groundwater contamination at the Southern Lobe. Active groundwater treatment is further warranted due to the concentrating and focusing of contaminated groundwater at the western edge of the Southern Lobe, which will occur when the vertical barrier is installed as part of the remedy. The vertical barrier will prevent contaminated groundwater from discharging directly to Sutton Brook and re-contaminating surface water and sediments, and will help direct contaminated groundwater at the Southern Lobe in a westerly direction to the "Area for Focused Groundwater Treatment" (see Figure L-1), where active groundwater treatment will occur. EPA is concerned that without active groundwater treatment, the focusing of additional contaminated groundwater to an area that is already experiencing high levels of groundwater contamination would be too much for MNA alone to address.

EPA has determined that MNA is currently occurring within groundwater at the Site and is helping (along with groundwater flow patterns) to restrict the spread of the contaminated groundwater plume. EPA has determined that the source control measures to be implemented as part of the remedy (including excavating contaminated soils and sediments and capping landfill lobes), will eliminate or reduce ongoing sources of contamination and will serve to support the success of MNA in the areas where active groundwater treatment is not proposed.

The actual locations for long-term groundwater monitoring, will be determined during remedial design (and may be subsequently modified if groundwater conditions change).

At this Site, there are three purposes for the monitoring. One purpose, as has been discussed, is to monitor the progress of MNA, and assess whether MNA is adequate to address groundwater contamination. A second purpose is to monitor whether and when, groundwater cleanup levels have been achieved. Cleanup levels must be achieved at and beyond the "point of compliance." For the Landfill Lobes, the point of compliance is defined as the edge of the Lobes. Long-term monitoring wells will be installed downgradient of the landfill to monitor this point of compliance. The third purpose of long-term monitoring is to monitor the size and location of the contaminated groundwater plume to ensure that it is not spreading beyond its current bounds. In order to make this assessment, wells would need to be located beyond the current bounds of the plume.

C. Questions and Comments Regarding the Scope of the Remedial Investigation and Feasibility Study (RI/FS):

C.1. One commenter expressed concern that data from residential properties at Bemis Circle and Homestead Lane were not adequately factored into the remedial investigation or decision-making. Two commenters asserted that data from the so-called Perkins Property, northeast of the northern lobe, had not been adequately considered and improperly considered as a "background" location.

EPA Response:

As stated in the comment, past investigations have occurred at the Bemis Circle property. These investigations involved the sampling of groundwater, soils, soil gas and indoor air. In general, detected contaminants were present at very low concentrations, and with regard to groundwater in particular (the presumed transport mechanism for any contamination, if one were to exist), the concentrations were well below any potential action level. EPA does not agree with the commentors' conclusion that data suggest that the source of contamination is "in the direction of the landfill and the Former Drum Disposal Area." Groundwater from three wells on the property was sampled and analyzed in December 2006. Results at all three wells showed very low levels of a few contaminants, with the well closest to the Sutton Brook Disposal Area showing fewer contaminant detections than the next closest well. Lines of evidence (local and regional groundwater flow directions as determined by groundwater elevations in monitoring wells, contaminant distribution and concentrations in groundwater throughout the area), support the RI conclusion that Sutton Brook is the dominant water feature in the area, and that groundwater flows towards Sutton Brook. This evidence shows that groundwater from the Site source areas flows to Sutton Brook rather than to Bemis Circle.

EPA has determined that groundwater from the Sutton Brook Disposal Area Superfund Site is not the cause of this contamination and that there is insufficient evidence to support this conclusion.

Regarding the Homestead Lane property, EPA has determined that this property is upgradient of the Sutton Brook Disposal Area. As such, any contamination found on this property would not have been the result of contamination at the Site. Nonetheless, it was EPA's intention that the irrigation well on the property be re-sampled during the RI/FS. Unfortunately, difficulties coordinating with the homeowner prevented re-sampling from occurring prior to completion of the RI/FS (although the homeowner does not object to the sampling). Re-sampling of the groundwater at this property will be conducted as part of future groundwater monitoring.

The Perkins Property is located northeast of the landfill, across the former railroad bed. EPA acknowledges that groundwater from the Northern Lobe may have impacted the edge of the Perkins Property due to hydraulic mounding; this is shown on figures in the RI report. However, although a comment notes that the property "has not previously been used for any commercial, industrial, or residential use other than possibly homesteading and grazing by livestock," there is evidence that activities such as excavation, filling, and disposal, have occurred on the property. As the groundwater flow direction is generally from the Perkins Property towards the Northern Lobe and Sutton Brook, the extent of the hydraulic mounding is not anticipated to be significant. The data evaluated during the RI phase of the project did not show significant detections at the locations which are currently considered "reference." These findings did not justify further sampling in that area to refine the extent of contamination in that area.

During the design and remedy implementation phase of the selected remedy, a landfill monitoring program will be established. At that time, EPA will review any new information, as well as perform additional testing regarding the extent of the landfill (and associated contamination) to properly implement the monitoring program.

C.2 One commenter noted that two other sites had not been adequately considered as part of the site investigation, 79 McDonald Road and the Krochmal Farm site (also known as the Wilmington Disposal Area), and asked about the regulatory status of the Krochmal Farm property.

<u>EPA Response:</u>

At the time that the documentation proposing the Sutton Brook Disposal Area to the National Priorities List (NPL) was being compiled, there existed three known areas which were in the process of undergoing removal actions (79 McDonald Road, the Krochmal Farm Site or Wilmington Disposal Area, and Rocco's Landfill). When the Site was proposed to the NPL, there was no certainty as to whether the removal actions would be completed prior to final site listing or if additional work (removal or investigations) would be necessary. The language proposing the Site to the NPL was intended to be flexible to allow for inclusion, as part of the Site, of any removal area at which either the removal had not been completed, or at which follow-up activities remained which would be appropriately addressed under Superfund.

At the time when the Sutton Brook Disposal Area Superfund Site's NPL listing was finalized in June 2001, the 79 McDonald Road removal had been completed by the property owners, and applications had been made for the property to be further addressed as necessary, within the Massachusetts Chapter 21E Cleanup Program. The removal at the Krochmal Farm/Wilmington Disposal Area had been completed by EPA. EPA and MassDEP agreed at that time that there was a remaining soil issue to be addressed (low concentrations of PCBs) and that MassDEP would take the lead in addressing it. It was further agreed that, given the relatively minor nature of the remaining issue, there was no reason to include that area in the final listing of the Site. It should be noted that EPA had already completed extensive electromagnetic (EM) surveys within the farm property searching for drums and buried waste.

MassDEP has informed EPA that the Krochmal Farm site has a Release Tracking Number and is within their tracking system.

C.3. The MBTA asked whether the RI/FS documented impacts to benthic organisms and whether EPA had evaluated the long-term benefits of re-establishing benthic organisms vs. short-term impacts of the proposed Sutton Brook sediment excavation.

<u>EPA Response:</u>

The site channel portion of Sutton Brook directly between the landfill lobes was evaluated by a comparison of five surface water and sediment samples to effects-based NOAEL (No Observed Adverse Effects Level) benchmarks in the screening-level step of the Baseline Ecological Risk Assessment (BERA). Consistent with EPA's Guidance on Presumptive Remedy for CERCLA Municipal Landfill Sites, additional baseline ecological effects assessment of exposure to contaminants in the site channel portion of the Brook (located between the landfill lobes) was not conducted in the BERA because of the assumption that a remedy would have to address the high risk of COPCs in the site channel. In addition, it was assumed that because of the close proximity of Sutton Brook to the landfill lobes, construction activities would significantly impact this portion of Sutton Brook and would essentially be equal to excavation of brook sediment. Given that the contaminant concentrations detected in surface water and sediments in the area between the landfill lobes exceeded screening-level benchmarks, the PRP group (who performed the RI/FS) and EPA agreed that making the assumption that surface water and sediments between the lobes exceeded risk criteria was reasonable. Because of this, toxicity testing, which would have documented impacts to organisms (if the impacts exist) was not conducted as part of the RI in this portion of Sutton Brook. The comment also questioned whether a comparison had been made between the benefits of re-establishing benthic organisms in Sutton Brook, in between the Landfill Lobes, and the short-term impacts of excavation and consolidation of sediments. The comparison suggested was not made, because as described above, significant impacts to the Sutton Brook sediments in-between the Landfill Lobes are expected due to construction activities. These expected construction impacts, were the primary reason for only comparing samples with NOAEL benchmarks, as described above.

C.4. Citing concerns about groundwater mounding and as a means for comparing alternatives, the MBTA asked whether a site-wide water balance assessment had been completed.

EPA Response:

Water balance assessments (e.g., precipitation, evaporation, groundwater and surface water flow rates and volumes, infiltration rates, etc.) were conducted during the RI and the FS in trying to understand water dynamics at the Site and to assess the impact of different potential remedial components (e.g., capping, vertical barrier, and extraction wells). Reference to these efforts can be found in Appendix F of the RI, Appendix F of the FS, as well as in the body of both documents.

C.5. The MBTA requested a detailed review of the cost estimates for each alternative.

EPA Response:

Cost estimates were prepared and developed for the Feasibility Study and the Record of Decision in accordance with the National Contingency Plan (NCP) and EPA's RI/FS Guidance. As such, cost estimates are intended to be accurate within +50 to -30 percent of the actual costs. These costs are intended to be used for comparative purposes, to allow for cost evaluation between different FS alternatives.

D. Questions and Comments Regarding Liability, Enforcement, and the Timetable for Remedy Implementation:

D.1. A number of comments and questions were received regarding identification and participation of additional Potentially Responsible Parties (PRPs).

EPA Response:

Since July of 2000, when EPA first notified parties of their liability with respect to buried drums at the Site, EPA has continued to pursue evidence on parties that may have liability at the Site. The purpose of this pursuit is to find additional potentially liable parties and ultimately reach a settlement with those parties under which they are compelled to undertake the cleanup of the Site. At the time of the settlement for performance of the RI/FS, EPA had identified 39 parties. Recently EPA notified an additional 23 parties of their potential liability at the Site. EPA will be meeting with representatives of these recently notified parties in October 2007. EPA expects to begin negotiating with all notified parties in the spring of 2008 regarding implementing the selected remedy.

D.2. A number of questions were raised regarding the timeline for implementation of the cleanup once the remedy is selected.

EPA Response:

When PRPs are known to exist at a site, EPA is obligated to pursue those parties and attempt to compel them to conduct site cleanups. This is the case at the Sutton Brook Disposal Area Site. As mentioned above, EPA will be negotiating with all notified parties regarding implementing the selected remedy. EPA expects to commence negotiations with the Site's PRPs by the spring of 2008. The amount of time needed to reach a settlement is uncertain. Following a settlement or an order, EPA estimates that 1-1.5 years will be required to design the remedy and that an estimated 2-3 years will be required to construct the remedy.

D.3. Several commenters asked about EPA's planned community notification and involvement process leading up to and during construction.

EPA Response:

EPA plans to conduct at least one informational meeting during the remedial design process (probably near completion) in order to discuss aspects of the design and schedule, as well as any implementation issues. In addition, EPA anticipates at least one, and probably two, informational meeting(s) during on-site construction to discuss progress and the upcoming schedule. It is anticipated that these meetings will be supplemented by informational mailings and/or press releases at key times during the design and construction process.

Appendix A

MassDEP Letter of Concurrence

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY & ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
ONE WINTER STREET, BOSTON, MA 02108 617-292-5500

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

IAN A. BOWLES
Secretary

LAURIE BURT
Commissioner

September 26, 2007

James T. Owens, Director
Office of Site Remediation and Restoration
Region 1
U.S. Environmental Protection Agency
One Congress Street, Suite 1100 (HIO)
Boston, MA 02114-2023

Re: ROD Concurrence Letter
Sutton Brook Disposal Area
Superfund Site, Tewksbury, MA

Dear Mr. Owens:

The Department of Environmental Protection (MassDEP) has reviewed the Record of Decision (ROD) and the Selected Remedial Action Alternative (Selected Remedy) recommended by the U.S. Environmental Protection Agency (EPA) for the Sutton Brook Disposal Area Superfund Site (the Site). MassDEP concurs with the Selected Remedy, subject to the matter noted below.

The Site, which is situated on the eastern boundary of the Town of Tewksbury and partially extends into the Town of Wilmington, is largely undeveloped. Nearby uses include open space, agriculture and residential. The Selected Remedy addresses several source areas within the Site by means of containment and treatment of groundwater, excavation of contaminated soil and sediment and consolidation with landfill waste, and landfill capping. These measures, in combination with land use restrictions, are intended to address Site risks by preventing exposure of the public to contaminants above cleanup goals, protecting the constructed remedy, preventing inappropriate land use, and protecting terrestrial and aquatic wildlife. The major components of the Selected Remedy include:

- excavation of contaminated soil and sediment above site-specific cleanup levels (soil at the Garage and Storage Area and the Former Drum Disposal Area, and sediment from Sutton Brook between the landfill lobes);
- consolidation of excavated soils, sediment, and debris into the landfill;
- construction of a multi-layer impermeable cap over the landfill lobes;
- interception of groundwater from the southern lobe;
- a combination of collection and treatment and monitored natural attenuation for contaminated groundwater;
- institutional controls; and

- long-term monitoring.

The Selected Remedy calls for institutional controls in certain specified areas in order to prevent future exposure, but does not provide the details of those institutional controls. Although MassDEP's ability to evaluate this aspect of the selected remedy is consequently limited, we acknowledge that the ROD indicates that the details of the institutional controls will be worked out during the pre-design and remedial design phases. As part of this process, MassDEP encourages the analysis of institutional controls alternatives and the evaluation of specific types of institutional controls, in accordance with relevant guidance and policies,[1] during the pre-design and remedial design phases.

MassDEP fully reserves all rights to evaluate and comment upon specific institutional controls that EPA may propose, and to determine MassDEP's participation, if any, in the development, implementation, administration and enforcement of such institutional controls as EPA may select or approve for the Selected Remedy.

MassDEP looks forward to working with you in implementing the Selected Remedy.

If you have any questions or comments, please contact Janet Waldron, Project Manager, at (617) 556-1156

Sincerely,

Janine Commerford
Assistant Commissioner
Bureau of Waste Site Cleanup

E-file: 5.01 Correspondence/07_0905_MassDEP_ConcurrenceLetter

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1 Reference is made to EPA's final fact sheet titled "Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups" EPA 540-F-00-005, OSWER 9355.0-74FS-P dated September 2000."

Appendix B

Groundwater Use and Value Determination

GROUNDWATER USE AND VALUE DETERMINATION
Sutton Brook Disposal Area NPL Site

July 2001

Consistent with the Environmental Protection Agency's (EPA) 1996 Final Ground Water Use and Value Determination Guidance, the Massachusetts Department of Environmental Protection (MADEP) has completed a "Groundwater Use and Value Determination" for groundwater in the vicinity of the Sutton Brook Disposal Area Site (the "Site"). The purpose of the Use and Value Determination is to identify whether the aquifer at the site should be considered of "High", "Medium", or "Low" use and value. In the development of this Determination, the MADEP has applied the criteria for groundwater classification as promulgated in the Massachusetts Contingency Plan (MCP). The classification contained in the MCP considers criteria similar to those recommended in the Use and Value Guidance. The Department's recommendation supports a Medium Use and Value for the groundwater underlying the site, provided that no new residential supply wells are identified by the Town of Tewksbury (in the vicinity of the site) and provided that existing private wells are routinely tested. An explanation for this recommendation is outlined below.

The Sutton Brook Disposal Area consists of approximately 100 acres of which approximately 50 acres were used as an unlined/uncapped landfill for the disposal of municipal, commercial, and industrial wastes, including (but not limited to): solvents, sewage, refuse, paint sludge, and steel drum reconditioning waste. Waste materials were deposited between 1957 until 1979 at which time the landfill was ordered closed by the Tewksbury Board of Health. According to available file information, indiscriminate dumping is believed to have continued for some time until approximately 1988.

Since approximately 1988, the property has been the focus of numerous environmental assessments by MA DEP and EPA. These assessments have (in general) included the installation of monitoring wells and the collection of sediment, soil, groundwater, and surface water samples. Contaminants frequently detected and thereby associated with the landfill include (partial listing only): volatile organic compounds (xylene, toluene, and tricloroethylene); semivolatile organic compounds (phenol, pyrene, fluoranthene, and chrysene); polychlorinated biphenyls; and inorganic element (arsenic, chromium, lead, and mercury). Based on ancillary information, EPA was informed and subsequently confirmed the presence of several drum disposal areas in the vicinity of the former landfill. As a result (in 1999 and 2000), EPA Removal personnel mobilized to the site and excavated and removed approximately 60 drums and associated contaminated soil.

In June 2001, the site was listed on the National Priorities List (NPL). Remedial activities completed to date have been primarily assessment activities (with the exception of the time-critical removal as a result of the buried drums). In regards to potential redevelopment scenarios, only very preliminary discussions have ensued. Based on the anticipated length of time until this phase of the project, the Department has not considered any specific redevelopment scenarios in this Groundwater Use and Value Determination, but assumes that at least a portion of the surrounding area could be developed. Accordingly, the Department may revise and/or modify this Determination, as appropriate, based on any final and unforeseen redevelopment scenarios.

For the purposes of this Determination, the groundwater under evaluation is defined as the groundwater under the boundaries of the Site as shown on the attached map. The groundwater beneath and in the vicinity of the Site is classified as GW-1 (see description below) and is designated a Potential Productive Aquifer. Moreover, the aquifer is categorized by the U.S. Geological Survey (USCS) as "medium yield". The GW-1 designation (and the associated standard) is considered protective of human health as a result of direct human consumption.

Drinking water for the majority of the Town of Tewksbury (including the area along South Street in the vicinity of the Site) is supplied by a surface water intake located on the Merrimac River; however, historically the town obtained its drinking water from nine public water supply wells. These wells were removed from service between the years of 1972 and 1992 due to VOC and metals contaminations. The closest of these wells is the Poplar Street Well Field (comprised of Well Nos. 8 through 12) located between 0.2 and 0.5 miles southwest of the site. In 1985, a hydrological evaluation was completed, including pump tests of two (of the five) Popular Street wells (Well Nos. 8 and 9). The results of this evaluation concluded that Sutton Brook Disposal Area was most likely <u>not</u> the source of contaminants to these wells; however, the closest of the wells (Well Nos. 10 through 12) were not part of the pump tests.

According to the Tewksbury Board of Health, there are several private wells within 0.25-miles of the site (see the attached memo dated February 16, 1999 from Thomas Carbone, Tewksbury Director of Public Health). The closest known private drinking water well is the drinking water well serving the on-site residence. This well has been repeatedly sampled; however, (to date) no contaminants have been detected. The location of this well is northwest (and presumably cross-gradient) from the Site. Based on recent conversations with Mr. Carbone (May 2001), a private well survey is being conducted to better determine the actual number of private wells in the vicinity of the site. Based on groundwater contour maps developed in 1995, groundwater flow is (locally) towards Sutton Brook, and regionally towards the west.

For the purposes of completing a risk assessment, considering the GW-1 designation and the average depth to groundwater in the vicinity (i.e., the perimeter) of the landfill (i.e., between 5 to 10 feet below ground surface), the risk assessment factors as it relates to groundwater beneath the Site should include, but not limited to, the following:

Human Health:

a) Potential human consumption and/or exposure as a result of existing and/or future private groundwater supply wells;
b) Excavation into groundwater (i.e., worker exposure);
c) Discharge into surface water and the consequential effects of the discharge (i.e., wading scenarios, recreation, and fishing); and
d) Potential migration of contaminants to indoor air (within occupied structures) and subsequent exposure to volatile contaminants (pending development of the site or on adjacent parcels which might overlie contaminated groundwater).

Ecological:

a) Effects on the biota that make up the benthic community; and
b) Effects on the biota that feed on or in the benthic community, and on up the food chain, as determined by the substance's persistence and ability to bioaccumulate.

Table 1 reviews the Site Area with respect to the eight factors contained in the Use and Value Determination Guidance. In light of the use and value factors and similar criteria established in the MCP, the Department supports a Medium Use and Value for groundwater in the vicinity of the Sutton Brook Disposal Site. As stated previously, pending future development scenarios, modifications to this determination may be warranted.

TABLE 1
SUTTON BROOK DISPOSAL AREA GROUNDWATER USE AND VALUE DETERMINATION
JULY 2001

Use and Value Factors	Site-specific Considerations	Use and Value Designation
Quantity	The aquifer beneath the site is designated as a medium-yield potentially productive aquifer by the USGS. Moreover, impacts to groundwater within the review area have been documented; however, the extent to which groundwater treatment will be required is unknown.	Medium
Quality	Groundwater beneath the site is contaminated with numerous substances, most notably: benzene, toluene, phenol, xylene, trichloroethylene, acetone, and various metals. Moreover, numerous public supply wells were closed as a result of many of these contaminants (the source of which has not been determined). The closest interim wellhead protection area is located between 0.5 and 1 mile southeast from the site (presumably cross-gradient from the on-site source). Contaminants in groundwater may pose a risk to private well users (in the vicinity of the site) through ingestion, direct contact, and inhalation of contaminants via volatilization.	Medium
Current Public Drinking Water Supply	The majority of the residents in the vicinity of the Site are supplied by public (municipal) water supply; the current source for this water supply is a surface water intake located on the Merrimac River. In general, the residences in the vicinity of the site have access to this municipal supply; however, there remain several private wells (including the water supply at the on-site residence) which are operable.	Medium
Current Private Drinking Water Supply	According to the Town of Tewksbury Board of Health, there are several private well users in the vicinity of the site. Specific uses of each of the private wells are unknown (agricultural, domestic, etc.). The closest private water supply (an on-site bedrock well) has been tested; no contaminants have been identified. This well is located cross-gradient from on-site sources. Accordingly, these well are threatened by the potential migration of on-site contaminants.	High
Likelihood and Identification of Future Drinking Water Use	The site is currently designated as a potentially productive aquifer and several private wells exist within 0.25 miles of the site. Based on the access to municipal water in the area, it is not expected that a significant number of new private wells or any public wells would be installed; however, the potential exists.	Medium
Other Current or Reasonable Expected Ground Water Use(s) in Review Area	At this time, there are no other projected uses of groundwater in the Review Area (excluding of drinking water).	Low
Ecological Value	A portion of the groundwater beneath the site discharges to Sutton Brook and (therefore) provides hydrologic support for a significant amount of freshwater wetlands located adjacent to this waterbody.	Medium

<u>TABLE 1</u>
SUTTON BROOK DISPOSAL AREA GROUNDWATER USE AND VALUE DETERMINATION
JULY 2001 (Concluded)

Public Opinion	Public opinion was solicited during the promulgation of the MCP regulations, groundwater standards, and groundwater classifications.	Medium

Appendix D

Tables

Appendix D - Tables – Contents

Table	Description
G-1	Chemicals of Concern (Soil)
G-2	Chemicals of Concern (Indoor Air)
G-3	Chemicals of Concern (Groundwater – Groups 1&2)
G-4	Chemicals of Concern (Groundwater – Groups 3-6)
G-5	Cancer Toxicity Data
G-6	Non-Cancer Toxicity Data
G-7	Risk Characterization Summary (GSA)
G-8	Risk Characterization Summary (FDDA - Residential)
G-9	Risk Characterization Summary (Landfill Lobes – Carcinogens)
G-10	Risk Characterization Summary (Landfill Lobes – Non-Carcinogens)
G-11	Risk Characterization Summary (Groundwater – Carcinogens) Residential
G-12	Risk Characterization Summary (Groundwater – Non-Carcinogens) Residential
G-13	Risk Characterization Summary (Groundwater – Carcinogens) Worker
G-14	Risk Characterization Summary (Groundwater – Carcinogens) Worker
G-15	Risk Characterization Summary (FDDA - Worker)
G-16	Chemicals of Concern (Upper Sutton Brook – Surface Water)
G-17	Chemicals of Concern (Upper Sutton Brook – Sediment)
G-18	Chemicals of Concern (Aquatic Wetland – Surface Water)
G-19	Chemicals of Concern (Aquatic Wetland – Sediment)
G-20	Chemicals of Concern (Wetland Soil)
G-21	Chemicals of Concern (Pond – Surface Water)
G-22	Chemicals of Concern (Pond – Sediment)
G-23	Chemicals of Concern (Upland Soil)
G-24	Ecological – Exposure Pathways of Concern
G-25	Ecological – Protective Chemical of Concern Concentrations
LF-1	Detailed Analysis – LF-1
LF-2a	Detailed Analysis – LF-2a
LF-2b	Detailed Analysis – LF-2b
LF-3	Detailed Analysis – LF-3
LF-4	Detailed Analysis – LF-4
FDDA-1	Detailed Analysis – FDDA-1
FDDA-2	Detailed Analysis – FDDA-2
FDDA-3	Detailed Analysis – FDDA-3
FDDA-4	Detailed Analysis – FDDA-4
FDDA-5	Detailed Analysis – FDDA-5
GSA-1	Detailed Analysis – GSA-1
GSA-2	Detailed Analysis – GSA-2
DGGW-1	Detailed Analysis – DGGW-1
DGGW-2	Detailed Analysis – DGGW-2
DGGW-3	Detailed Analysis – DGGW-3
DGGW-4	Detailed Analysis – DGGW-4
K-1	Comparative Analysis – Landfill Lobes

Appendix D – Tables – Contents (continued)

Table	Description
K-2	Comparative Analysis – FDDA
K-3	Comparative Analysis – GSA
K-4	Comparative Analysis – DGGW
L-1	Cleanup Levels – Human Health – Groundwater
L-2	Cleanup Levels – Human Health – Soil
L-3	Cleanup Levels – Ecological – Soil
L-4	Cleanup Levels – Ecological – Surface Water
L-5	Cleanup Levels – Ecological – Sediment
M-1	Landfill Lobes ARARs – Chemical Specific
M-2	Landfill Lobes ARARs – Action Specific
M-3	Landfill Lobes ARARs – Location Specific
M-4	FDDA ARARs – Chemical Specific
M-5	FDDA ARARs – Action Specific
M-6	FDDA ARARs – Location Specific
M-7	GSA ARARs – Chemical Specific
M-8	GSA ARARs – Action Specific
M-9	GSA ARARs – Location Specific
M-10	DGGW ARARs – Chemical Specific
M-11	DGGW ARARs – Action Specific
M-12	DGGW ARARs – Location Specific

Table G-1

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Soil
Exposure Medium: Upland Soil (0-10')

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					(1)
GSA, Upland								
	Benzo(a)anthracene	0.046	45	mg/kg	10 / 13	38.0	mg/kg	95% UCL
	Benzo(a)pyrene	0.042	27	mg/kg	10 / 13	22.8	mg/kg	95% UCL
	Benzo(b)fluoranthene	0.066	19	mg/kg	10 / 13	16.1	mg/kg	95% UCL
	Benzo(k)fluoranthene	0.08	24	mg/kg	8 / 13	20.27	mg/kg	95% UCL
	Dibenz(a,h)anthracene	0.068	4.5	mg/kg	5 / 13	3.882	mg/kg	95% UCL
	Indeno(1,2,3-cd)pyrene	0.11	10	mg/kg	9 / 13	8.49	mg/kg	95% UCL

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL (95% UCL); Arithmetic Mean (Mean)

GSA = Garage and Storage Area (Group 4)

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in upland soil (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in upland soil). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that the carcinogenic PAHs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene are the only COCs in upland soil at the site. The 95% UCL on the arithmetic mean was used as the EPC for these six carcinogenic PAHs.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table G-2

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Indoor Air

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					(1)
FFDA								
	Toluene	0.32	78000	ug/L	9 / 24	8300	ug/m^3	Max
	Xylenes (total)	0.43	28200	ug/L	10 / 24	2500	ug/m^3	Max

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL (95% UCL); Arithmetic Mean (Mean)

FDDA = Former Drum Disposal Area (Group 3)

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs for the vapor intrusion (i.e., indoor air) pathway that were detected in groundwater (i.e., the concentrations that will be used to estimate the exposure and risk for each COC for the vapor intrusion pathway). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that the volatile organic chemicals, toluene and xylenes, are the most frequently detected COCs in groundwater that may potentially impact indoor air at the site. The maximum detected groundwater concentration was used to estimate a maximum indoor air concentration that was used as the EPC for each of the COCs selected for the vapor intrusion pathway.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table G-3

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Potable Groundwater

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure
		Minimum	Maximum					(1)
Groups 1 & 2								
	1,2-Dichloroethane	2	6.9	ug/L	2 / 73	6.9	ug/L	Max
	1,2-Dichloroethene (total)	150	150	ug/L	1 / 8	150	ug/L	Max
	1,2-Dichloropropane	0.37	3.4	ug/L	2 / 73	3.4	ug/L	Max
	1,4-Dichlorobenzene	0.48	11	ug/L	20 / 74	11	ug/L	Max
	1,4-Dioxane	2.2	830	ug/L	40 / 53	830	ug/L	Max
	2-Butanone	17	27000	ug/L	21 / 65	27000	ug/L	Max
	4-Methyl-2-pentanone	10	13000	ug/L	28 / 65	13000	ug/L	Max
	Acetone	2.5	21000	ug/L	25 / 65	21000	ug/L	Max
	Benzene	0.31	38	ug/L	28 / 69	38	ug/L	Max
	Chloroform	1.7	1.7	ug/L	1 / 73	1.7	ug/L	Max
	cis-1,2-Dichloroethene	0.47	450	ug/L	20 / 88	450	ug/L	Max
	Ethylbenzene	1.3	2000	ug/L	32 / 74	2000	ug/L	Max
	Methylene chloride	0.42	2140	ug/L	8 / 72	2140	ug/L	Max
	n-Propylbenzene	0.42	260	ug/L	14 / 63	260	ug/L	Max
	Tetrachloroethene	0.72	17	ug/L	3 / 72	17	ug/L	Max
	Tetrahydrofuran	2.5	10000	ug/L	40 / 57	10000	ug/L	Max
	Toluene	0.53	21000	ug/L	39 / 78	21000	ug/L	Max
	Trichloroethene	1.1	76	ug/L	9 / 74	76	ug/L	Max
	Vinyl Chloride	1	35	ug/L	4 / 72	35	ug/L	Max
	Xylenes (total)	0.38	490	ug/L	46 / 78	490	ug/L	Max
	3-/4-Methylphenol	6.6	10000	ug/L	20 / 38	10000	ug/L	Max
	4-Methylphenol	6600	11000	ug/L	4 / 8	11000	ug/L	Max
	Naphthalene	0.48	240	ug/L	15 / 77	240	ug/L	Max
	N-Nitrosodi-n-butylamine	1.08	1.08	ug/L	1 / 9	1.08	ug/L	Max
	N-Nitrosopyrrolidine	9.68	9.68	ug/L	1 / 9	9.68	ug/L	Max
	o-Toluidine	3.16	3.16	ug/L	1 / 9	3.16	ug/L	Max
	Pyridine	29	42	ug/L	2 / 38	42	ug/L	Max
	Arsenic	3.8	2000	ug/L	62 / 77	2000	ug/L	Max
	Beryllium	0.5	30	ug/L	13 / 57	30	ug/L	Max
	Cadmium	0.4	360	ug/L	23 / 76	360	ug/L	Max
	Manganese	40	20200	ug/L	64 / 64	20200	ug/L	Max
	Thallium	3.8	4.7	ug/L	3 / 60	4.7	ug/L	Max

Key

(1) Statistics: Maximum Detected Value (Max); 95% UCL (95% UCL); Arithmetic Mean (Mean)

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in Groups 1 & 2 groundwater (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in Groups 1 & 2 groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that the inorganic chemicals, arsenic and manganese, and the organic chemicals, 1,4-dioxane, 4-methyl-2-pentanone, benzene, ethylbenzene, tetrahydrofuran, toluene, xylenes, and methylphenols are the most frequently detected COCs in groundwater at the site. The maximum detected concentration was used as the EPC for each of the COCs detected in groundwater.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table G-4

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Potable Groundwater

Exposure Point	Chemical of Concern	Concentration Detected Minimum	Concentration Detected Maximum	Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
Groups 3-6								
	1,1,2-Trichloroethane	3	6.92	ug/L	2/93	6.92	ug/L	Max
	1,1-Dichloroethane	0.23	3600	ug/L	40/148	3600	ug/L	Max
	1,2-Dichloroethane	0.29	44.4	ug/L	21/131	44.4	ug/L	Max
	1,2-Dichloroethene (total)	2	130	ug/L	2/4	130	ug/L	Max
	1,2-Dichloropropane	0.35	3.6	ug/L	3/118	3.6	ug/L	Max
	1,4-Dichlorobenzene	0.56	3.2	ug/L	10/118	3.2	ug/L	Max
	1,4-Dioxane	1.6	3000	ug/L	58/120	3000	ug/L	Max
	2-Butanone	22	77000	ug/L	10/126	77000	ug/L	Max
	4-Methyl-2-pentanone	1	190000	ug/L	15/127	190000	ug/L	Max
	Acetone	2.1	73000	ug/L	16/125	73000	ug/L	Max
	Acrylonitrile	800	1300	ug/L	3/24	1300	ug/L	Max
	Benzene	0.12	45	ug/L	39/131	45	ug/L	Max
	Carbon Tetrachloride	52	52	ug/L	1/93	52	ug/L	Max
	Chloroform	0.28	5.7	ug/L	2/108	5.7	ug/L	Max
	cis-1,2-Dichloroethene	0.18	220	ug/L	42/127	220	ug/L	Max
	Ethyl methacrylate	4000	4000	ug/L	1/24	4000	ug/L	Max
	Ethylbenzene	0.04	8400	ug/L	38/148	8400	ug/L	Max
	Methylene chloride	0.55	2200	ug/L	6/130	2200	ug/L	Max
	n-Propylbenzene	0.39	92	ug/L	24/115	92	ug/L	Max
	Tetrachloroethene	0.22	8	ug/L	9/133	8	ug/L	Max
	Tetrahydrofuran	1.9	20000	ug/L	40/115	20000	ug/L	Max
	Toluene	0.32	78000	ug/L	30/132	78000	ug/L	Max
	Trichloroethene	0.1	8	ug/L	20/134	8	ug/L	Max
	Vinyl Chloride	0.31	71	ug/L	14/117	71	ug/L	Max
	Xylenes (total)	0.1	28200	ug/L	50/148	28200	ug/L	Max
	alpha-BHC	0.047	0.047	ug/L	1/14	0.047	ug/L	Max
	Aroclor-1254	1.2	1.2	ug/L	1/3	1.2	ug/L	Max
	2-Methylphenol	1.7	1000	ug/L	14/65	1000	ug/L	Max
	3-/4-Methylphenol	40	2100	ug/L	13/49	2100	ug/L	Max
	bis(2-Ethylhexyl)phthalate	7.3	610	ug/L	3/70	610	ug/L	Max
	Naphthalene	0.49	11	ug/L	5/118	11	ug/L	Max
	Phenol	0.559	9400	ug/L	11/65	9400	ug/L	Max
	Antimony	3.8	100	ug/L	4/107	100	ug/L	Max
	Arsenic	0.0195	2320	ug/L	100/141	2320	ug/L	Max
	Beryllium	0.4	560	ug/L	21/128	560	ug/L	Max
	Cadmium	0.4	60	ug/L	18/141	60	ug/L	Max
	Chromium	0.7	30	ug/L	34/126	30	ug/L	Max
	Manganese	0.0595	29000	ug/L	129/133	29000	ug/L	Max
	Silver	0.7	800	ug/L	14/130	800	ug/L	Max
	Thallium	0.05	4.8	ug/L	8/107	4.8	ug/L	Max
	Zinc	4.1	55000	ug/L	39/130	55000	ug/L	Max

Key

(1) Statistics: Maximum Detected Value (Max), 95% UCL (95% UCL), Arithmetic Mean (Mean)

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in Groups 3-6 groundwater (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in Groups 3-6 groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that the inorganic chemicals, arsenic, chromium, manganese, and zinc, and the organic chemicals 1,1-dichloroethane, 1,4-dioxane, benzene, cis-1,2-dichloroethene, ethylbenzene, tetrahydrofuran, toluene, xylenes, and methylphenols are the most frequently detected COCs in groundwater at the site. The maximum detected concentration was used as the EPC for each of the COCs detected in groundwater.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table G-5

Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
1,1,2-Trichloroethane	5.7E-02	5.7E-02	(mg/kg-day)$^{-1}$	C	IRIS	03/07/07
1,1-Dichloroethane	N/A	N/A	N/A	C	N/A	N/A
1,2-Dichloroethane	9.1E-02	9.1E-02	(mg/kg-day)$^{-1}$	B2	IRIS	03/07/07
1,2-Dichloroethene (total)	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloropropane	6.8E-02	6.8E-02	(mg/kg-day)$^{-1}$	N/A	HEAST	1997
1,4-Dichlorobenzene	2.4E-02	2.4E-02	(mg/kg-day)$^{-1}$	N/A	HEAST	1997
1,4-Dioxane	1.1E-02	1.1E-02	(mg/kg-day)$^{-1}$	B2	IRIS	03/07/07
2-Butanone	N/A	N/A	N/A	N/A	N/A	N/A
4-Methyl-2-pentanone	N/A	N/A	N/A	N/A	N/A	N/A
Acetone	N/A	N/A	N/A	N/A	N/A	N/A
Acrylonitrile	5.4E-01	5.4E-01	(mg/kg-day)$^{-1}$	B1	IRIS	03/07/07
Benzene	5.5E-02	5.5E-02	(mg/kg-day)$^{-1}$	A	IRIS	03/07/07
Carbon Tetrachloride	1.3E-01	1.3E-01	(mg/kg-day)$^{-1}$	B2	IRIS	03/07/07
Chloroform	3.1E-02	3.1E-02	(mg/kg-day)$^{-1}$	B2	CalEPA	2005
cis-1,2-Dichloroethene	N/A	N/A	N/A	D	N/A	N/A
Ethyl methacrylate	N/A	N/A	N/A	N/A	N/A	N/A
Ethylbenzene	N/A	N/A	N/A	D	N/A	N/A
Methylene chloride	7.5E-03	7.5E-03	(mg/kg-day)$^{-1}$	B2	IRIS	03/07/07
n-Propylbenzene	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	5.4E-01	5.4E-01	(mg/kg-day)$^{-1}$	B1	CalEPA	2005
Tetrahydrofuran	N/A	N/A	N/A	N/A	N/A	N/A
Toluene	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	4.0E-01	4.0E-01	(mg/kg-day)$^{-1}$	N/A	EPA	2001
Vinyl Chloride - adult	7.2E-01	7.2E-01	(mg/kg-day)$^{-1}$	A	IRIS	03/07/07
Vinyl Chloride - lifetime	1.5E+00	1.5E+00	(mg/kg-day)$^{-1}$	A	IRIS	03/07/07
Xylenes (total)	N/A	N/A	N/A	N/A	N/A	N/A
2-Methylphenol	N/A	N/A	N/A	C	N/A	N/A
3-/4-Methylphenol	N/A	N/A	N/A	N/A	N/A	N/A
4-Methylphenol	N/A	N/A	N/A	C	N/A	N/A
Benzo(a)anthracene	7.3E-01	7.3E-01	(mg/kg-day)$^{-1}$	N/A	IRIS (2)	03/07/07
Benzo(a)pyrene	7.3E+00	7.3E+00	(mg/kg-day)$^{-1}$	B2	IRIS	03/07/07
Benzo(b)fluoranthene	7.3E-01	7.3E-01	(mg/kg-day)$^{-1}$	B2	IRIS (2)	03/07/07
Benzo(k)fluoranthene	7.3E-02	7.3E-02	(mg/kg-day)$^{-1}$	B2	IRIS (2)	03/07/07
bis(2-Ethylhexyl)phthalate	1.4E-02	1.4E-02	(mg/kg-day)$^{-1}$	B2	IRIS	03/07/07
Dibenz(a,h)anthracene	7.3E+00	7.3E+00	(mg/kg-day)$^{-1}$	B2	IRIS (2)	03/07/07
Indeno(1,2,3-cd)pyrene	7.3E-01	7.3E-01	(mg/kg-day)$^{-1}$	B2	IRIS (2)	03/07/07
Naphthalene	N/A	N/A	N/A	C	N/A	N/A
N-Nitrosodi-n-butylamine	5.4E+00	5.4E+00	(mg/kg-day)$^{-1}$	B2	IRIS	03/07/07
N-Nitrosopyrrolidine	2.1E+00	2.1E+00	(mg/kg-day)$^{-1}$	B2	IRIS	03/07/07
o-Toluidine	2.4E-01	2.4E-01	(mg/kg-day)$^{-1}$	N/A	HEAST	1997
Phenol	N/A	N/A	N/A	D	N/A	N/A
Pyridine	N/A	N/A	N/A	N/A	N/A	N/A
alpha-BHC	6.3E+00	6.3E+00	(mg/kg-day)$^{-1}$	B2	IRIS	03/07/07
Aroclor-1254 (water)	4.0E-01	4.0E-01	(mg/kg-day)$^{-1}$	B2	IRIS	03/07/07
Antimony	N/A	N/A	N/A	N/A	N/A	N/A
Arsenic	1.5E+00	1.5E+00	(mg/kg-day)$^{-1}$	A	IRIS	03/07/07
Beryllium	N/A	N/A	N/A	B1	N/A	N/A
Cadmium	N/A	N/A	N/A	B1 (via inhalation)	N/A	N/A
Chromium	N/A	N/A	N/A	A (via inhalation)	N/A	N/A
Manganese	N/A	N/A	N/A	D	N/A	N/A
Silver	N/A	N/A	N/A	D	N/A	N/A
Thallium	N/A	N/A	N/A	D	N/A	N/A
Zinc	N/A	N/A	N/A	D	N/A	N/A

Pathway: Inhalation

Chemical of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Units	Weight of Evidence/Cancer Guideline Description	Source	Date (MM/DD/YYYY)
1,1,2-Trichloroethane	1.6E-05	(ug/m^3)$^{-1}$	5.6E-02	(mg/kg-day)$^{-1}$	C	IRIS*	03/07/07
1,1-Dichloroethane	N/A	N/A	N/A	N/A	C	N/A	N/A
1,2-Dichloroethane	2.6E-05	(ug/m^3)$^{-1}$	9.1E-02	(mg/kg-day)$^{-1}$	B2	IRIS*	03/07/07
1,2-Dichloroethene (total)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,4-Dioxane	7.7E-06	(ug/m^3)$^{-1}$	2.7E-02	(mg/kg-day)$^{-1}$	B2	CalEPA*	2005
2-Butanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table G-5

Cancer Toxicity Data Summary

4-Methyl-2-pentanone	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Acetone	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Acrylonitrile	6.8E-05	$(ug/m^3)^{-1}$	2.38E-01	$(mg/kg\text{-}day)^{-1}$	B1	IRIS	03/07/07
Benzene	7.8E-06	$(ug/m^3)^{-1}$	2.73E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS*	03/07/07
Carbon Tetrachloride	1.5E-05	$(ug/m^3)^{-1}$	5.25E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS*	03/07/07
Chloroform	2.3E-05	$(ug/m^3)^{-1}$	8.05E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS*	03/07/07
cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	D	N/A	N/A
Ethyl methacrylate	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ethylbenzene	N/A	N/A	N/A	N/A	D	N/A	N/A
Methylene chloride	4.7E-07	$(ug/m^3)^{-1}$	1.65E-03	$(mg/kg\text{-}day)^{-1}$	B2	IRIS*	03/07/07
n-Propylbenzene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	5.9E-06	$(ug/m^3)^{-1}$	2.07E-02	$(mg/kg\text{-}day)^{-1}$	B1	CalEPA	2005
Tetrahydrofuran	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Toluene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Trichloroethene	2.0E-06	$(ug/m^3)^{-1}$	7.00E+00	$(mg/kg\text{-}day)^{-1}$	N/A	CalEPA	2005
Vinyl Chloride - adult	4.4E-06	$(ug/m^3)^{-1}$	1.54E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS*	03/07/07
Vinyl Chloride - lifetime	8.8E-06	$(ug/m^3)^{-1}$	3.08E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS*	03/07/07
Xylenes (total)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2-Methylphenol	N/A	N/A	N/A	N/A	C	N/A	N/A
3-/4-Methylphenol	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4-Methylphenol	N/A	N/A	N/A	N/A	C	N/A	N/A
bis(2-Ethylhexyl)phthalate	2.4E-06	$(ug/m^3)^{-1}$	8.4E-03	$(mg/kg\text{-}day)^{-1}$	B2	CalEPA	2005
Naphthalene	N/A	N/A	N/A	N/A	C	N/A	N/A
N-Nitrosodi-n-butylamine	1.6E-03	$(ug/m^3)^{-1}$	5.6E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS*	03/07/07
N-Nitrosopyrrolidine	6.1E-04	$(ug/m^3)^{-1}$	2.14E+00	$(mg/kg\text{-}day)^{-1}$	B2	IRIS*	03/07/07
Phenol	N/A	N/A	N/A	N/A	D	N/A	N/A
Pyridine	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Key

N/A Not applicable

IRIS Integrated Risk Information System, U.S. EPA

HEAST = National Center for Exposure Assessment, Health Effects Assessment Summary Tables

CalEPA = California Environmental Protection Agency

(2) The following toxicity equivalency factors (TEFs) were applied to the toxicity value for benzo(a)pyrene to derive a toxicity value for carcinogenic PAHs

Benzo(a)anthracene 0.1
Benzo(a)pyrene 1
Benzo(b)fluoranthene 0.1
Benzo(k)fluoranthene 0.01
Dibenz(a,h)anthracene 1
Indeno(1,2,3-cd)pyrene 0.1

EPA Group

A - Human carcinogen

B1 - Probable human carcinogen - Indicates that limited human data are available

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans

C - Possible human carcinogen

D - Not classifiable as a human carcinogen

E - Evidence of noncarcinogenicity

* - indicates slope factor calculated from unit risk; SF = 70 kg / 20 m^3-d^{-1} * UR

This table provides the carcinogenic risk information which is relevant to the contaminants of concern in upland soil, indoor air, and groundwater. At this time, slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in this assessment have been extrapolated from oral values. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularly important for chemicals with less than 50% absorption via the ingestion route. However, adjustment is not necessary for the chemicals evaluated at this site. Therefore, the same values presented above were used as the dermal carcinogenic slope factors for these contaminants. Fifteen of the COCs are also considered carcinogenic via the inhalation route. Aroclor 1254, alpha-BHC, and arsenic, as non-volatile contaminants, were not included in the evaluation of inhalation exposures.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table G-6

Non-Cancer Toxicity Data Summary

Pathway: Ingestion, Dermal

Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of Rfd: Target Organ (MM/DD/YYYY)
1,1,2-Trichloroethane	Chronic	4.0E-03	mg/kg-day	4.0E-03	mg/kg-day	Blood	1000	IRIS	03/07/07
1,1-Dichloroethane	Chronic	2.0E-01	mg/kg-day	2.0E-01	mg/kg-day	CNS		PPRTV	01/27/05
1,2-Dichloroethane	Chronic	2.0E-01	mg/kg-day	2.0E-01	mg/kg-day	Kidney	300	ATSDR MRL (intermediate)	09/01/01
1,2-Dichloroethene (total)	Chronic	9.0E-03	mg/kg-day	9.0E-03	mg/kg-day	Liver		HEAST	1997
1,2-Dichloropropane	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,4-Dichlorobenzene	Chronic	9.0E-02	mg/kg-day	9.0E-02	mg/kg-day	Developmental	1000	IRIS (2)	03/07/07
1,4-Dioxane	Chronic	1.0E-01	mg/kg-day	1.0E-01	mg/kg-day	Liver	100	ATSDR MRL	10/01/04
2-Butanone	Chronic	6.0E-01	mg/kg-day	6.0E-01	mg/kg-day	Developmental	1000	IRIS	03/07/07
4-Methyl-2-pentanone	Chronic	8.0E-02	mg/kg-day	8.0E-02	mg/kg-day	Liver; Kidney	3000	HEAST	1997
Acetone	Chronic	9.0E-01	mg/kg-day	9.0E-01	mg/kg-day	Kidney	1000	IRIS	03/07/07
Acrylonitrile	Chronic	1.0E-03	mg/kg-day	1.0E-03	mg/kg-day	Reproductive	1000	HEAST	1997
Benzene	Chronic	4.0E-03	mg/kg-day	4.0E-03	mg/kg-day	Immune System	300	IRIS	03/07/07
Carbon Tetrachloride	Chronic	7.0E-04	mg/kg-day	7.0E-04	mg/kg-day	Liver	1000	IRIS	03/07/07
Chloroform	Chronic	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	Liver	100	IRIS	03/07/07
cis-1,2-Dichloroethene	Chronic	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	Blood		PPRTV	03/01/06
Ethyl methacrylate	Chronic	9.0E-02	mg/kg-day	9.0E-02	mg/kg-day	Kidney	100	HEAST	1997
Ethylbenzene	Chronic	1.0E-01	mg/kg-day	1.0E-01	mg/kg-day	Liver; Kidney	1000	IRIS	03/07/07
Methylene chloride	Chronic	6.0E-02	mg/kg-day	6.0E-02	mg/kg-day	Liver	100	IRIS	03/07/07
n-Propylbenzene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Tetrachloroethene	Chronic	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	Liver	1000	IRIS	03/07/07
Tetrahydrofuran	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Toluene	Chronic	8.0E-02	mg/kg-day	8.0E-02	mg/kg-day	Kidney	3000	IRIS	03/07/07
Trichloroethene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl Chloride	Chronic	3.0E-03	mg/kg-day	3.0E-03	mg/kg-day	Liver	30	IRIS	03/07/07
Xylenes (total)	Chronic	2.0E-01	mg/kg-day	2.0E-01	mg/kg-day	General Toxicity	1000	IRIS	03/07/07
2-Methylphenol	Chronic	5.0E-02	mg/kg-day	5.0E-02	mg/kg-day	General Toxicity; CNS	1000	IRIS	03/07/07
3-/4-Methylphenol	Chronic	5.0E-02	mg/kg-day	5.0E-02	mg/kg-day	General Toxicity; CNS	1000	IRIS (value for 3-methylphenol)	03/07/07
4-Methylphenol	Chronic	5.0E-02	mg/kg-day	5.0E-02	mg/kg-day	General Toxicity; CNS	1000	IRIS (value for 3-methylphenol)	03/07/07
Benzo(a)anthracene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(a)pyrene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(b)fluoranthene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzo(k)fluoranthene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
bis(2-Ethylhexyl)phthalate	Chronic	2.0E-02	mg/kg-day	2.0E-02	mg/kg-day	Liver	1000	IRIS	03/07/07
Dibenz(a,h)anthracene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Indeno(1,2,3-cd)pyrene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Naphthalene	Chronic	2.0E-02	mg/kg-day	2.0E-02	mg/kg-day	General Toxicity	3000	IRIS	03/07/07
N-Nitrosodi-n-butylamine	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N-Nitrosopyrrolidine	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
o-Toluidine	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Phenol	Chronic	3.0E-01	mg/kg-day	3.0E-01	mg/kg-day	Developmental	300	IRIS	03/07/07
Pyridine	Chronic	1.0E-03	mg/kg-day	1.0E-03	mg/kg-day	Liver	1000	IRIS	03/07/07
alpha-BHC	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Aroclor-1254	Chronic	2.0E-05	mg/kg-day	2.0E-05	mg/kg-day	Immune system	300	IRIS	03/07/07
Antimony	Chronic	4.0E-04	mg/kg-day	6.0E-05	mg/kg-day	General Toxicity	1000	IRIS	03/07/07
Arsenic	Chronic	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	Skin	3	IRIS	03/07/07
Beryllium	Chronic	2.0E-03	mg/kg-day	1.4E-05	mg/kg-day	Gastrointestinal System	300	IRIS	03/07/07
Cadmium	Chronic	5.0E-04	mg/kg-day	2.5E-04	mg/kg-day	Kidney	10	IRIS	03/07/07
Chromium	Chronic	3.0E-03	mg/kg-day	7.5E-05	mg/kg-day	Gastrointestinal System	3000	IRIS (values for Cr+6)	03/07/07
Manganese (water)	Chronic	4.7E-02	mg/kg-day	1.9E-03	mg/kg-day	CNS	1	IRIS (3)	03/07/07
Silver	Chronic	5.0E-03	mg/kg-day	2.0E-04	mg/kg-day	Skin	3	IRIS	03/07/07
Thallium	Chronic	8.0E-05	mg/kg-day	8.0E-05	mg/kg-day	Blood	3000	IRIS*	03/07/07
Zinc	Chronic	3.0E-01	mg/kg-day	3.0E-01	mg/kg-day	Blood	3	IRIS	03/07/07

Table G-6

Non-Cancer Toxicity Data Summary

Pathway: Inhalation

Chemical of Concern	Chronic/ Subchronic	Inhalation RfC	Inhalation RfC Units	Inhalation RfD	Inhalation RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfC: RfD: Target Organ	Dates (MM/DD/YYYY)
1,1,2-Trichloroethane	Chronic	14	ug/m^3	N/A	N/A	Blood	N/A	Calculated (1)	N/A
1,1-Dichloroethane	Chronic	50	ug/m^3	N/A	N/A	Kidney	N/A	HEAST	1997
1,2-Dichloroethane	Chronic	2430	ug/m^3	N/A	N/A	Liver	90	ATSDR MRL (0.6 ppm)	2005
1,2-Dichloroethene (total)	Chronic	60	ug/m^3	N/A	N/A	Respiratory system; liver	N/A	PPRTV (value for trans isomer)	03/01/06
1,4-Dioxane	Chronic	3000	ug/m^3	N/A	N/A	Developmental	N/A	CalEPA REL	09/21/06
2-Butanone	Chronic	5000	ug/m^3	N/A	N/A	Developmental	300	IRIS	03/07/07
4-Methyl-2-pentanone	Chronic	3000	ug/m^3	N/A	N/A	Developmental	300	IRIS	03/07/07
Acetone	Chronic	3150	ug/m^3	N/A	N/A	Kidney	N/A	Calculated (1)	N/A
Acrylonitrile	Chronic	3.5	ug/m^3	N/A	N/A	Respiratory system	1000	IRIS (value for isopropylbenzene; calculated from RfD)	03/07/07
Benzene	Chronic	30	ug/m^3	N/A	N/A	Immune System	300	IRIS	03/07/07
Carbon Tetrachloride	Chronic	2.45	ug/m^3	N/A	N/A	Liver	N/A	Calculated (1)	N/A
Chloroform	Chronic	300	ug/m^3	N/A	N/A	Kidney; developmental; gastrointestinal system	N/A	CalEPA REL	09/21/06
cis-1,2-Dichloroethene	Chronic	60	ug/m^3	N/A	N/A	Respiratory system; liver	N/A	PPRTV (value for trans isomer)	03/01/06
Ethyl methacrylate	Chronic	315	ug/m^3	N/A	N/A	Kidney	N/A	Calculated (1)	N/A
Ethylbenzene	Chronic	1000	ug/m^3	N/A	N/A	Developmental	300	IRIS	03/07/07
Methylene chloride	Chronic	3000	ug/m^3	N/A	N/A	Liver	100	HEAST	1997
n-Propylbenzene	Chronic	140	ug/m^3	N/A	N/A	N/A	N/A	Calculated (1)	N/A
Tetrachloroethene	Chronic	35	ug/m^3	N/A	N/A	CNS; respiratory system	N/A	CalEPA REL	01/17/06
Tetrahydrofuran	Chronic	301	ug/m^3	N/A	N/A	N/A	N/A	Calculated (1)	N/A
Toluene	Chronic	5000	ug/m^3	N/A	N/A	CNS	10	IRIS	03/07/07
Trichloroethene	Chronic	600	ug/m^3	N/A	N/A	CNS	N/A	CalEPA REL	09/21/06
Vinyl Chloride	Chronic	100	ug/m^3	N/A	N/A	Liver	30	IRIS	03/07/07
Xylenes (total)	Chronic	100	ug/m^3	N/A	N/A	CNS	300	IRIS	03/07/07
2-Methylphenol	Chronic	175	ug/m^3	N/A	N/A	General Toxicity; CNS	N/A	Calculated (1)	N/A
3-/4-Methylphenol	Chronic	17.5	ug/m^3	N/A	N/A	General Toxicity; CNS	N/A	Calculated (1)	N/A
4-Methylphenol	Chronic	17.5	ug/m^3	N/A	N/A	General Toxicity; CNS	N/A	Calculated (1)	N/A
bis(2-Ethylhexyl)phthalate	Chronic	70	ug/m^3	N/A	N/A	Liver	N/A	Calculated (1)	N/A
Naphthalene	Chronic	3	ug/m^3	N/A	N/A	Respiratory system	3000	IRIS	03/07/07
N-Nitrosodi-n-butylamine	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
N-Nitrosopyrrolidine	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Phenol	Chronic	200	ug/m^3	N/A	N/A	Gastrointestinal system, cardiovascular, CNS; kidney	N/A	CalEPA REL	09/21/06
Pyridine	Chronic	3.5	ug/m^3	N/A	N/A	Liver	N/A	Calculated (1)	N/A

Key

N/A - No information available

ATSDR MRL = Agency for Toxic Substances and Disease Registry, Minimum Risk Levels

IRIS - Integrated Risk Information System, U.S. EPA

HEAST = National Center for Exposure Assessment, Health Effects Assessment Summary Tables

PPRTV = Provisional Peer-Review Toxicity Values, obtained from Superfund Technical Support Center

CalEPA = California Environmental Protection Agency. REL = Reference Exposure Level.

(1) - RfC calculated from the oral RfD or, if no oral RfD was available, from the inhalation RfD provided in the EPA Region 9 PRG table (October 2004) RfC = RfDi * (70 kg / 20 m^3/day).

(2) - RfD for 1,2-dichlorobenzene used as surrogate

(3) - A modifying factor of 3 was applied to the oral RfD for manganese to account for drinking water exposures, in accordance with EPA IRIS Recommendations

This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in upland soil, indoor air, and groundwater. Thirty-eight of the COCs have oral toxicity data indicating their potential for adverse non-carcinogenic health effects in humans. Chronic and subchronic toxicity data available for the thirty-eight COCs for oral exposures have been used to develop chronic oral reference doses (RfDs), provided in this table The available chronic and subchronic toxicty data indicate that benzene and Aroclor-1254 affect the immune system, 1,2-dichloroethene, 1,4-dioxane, 4-methyl-2-pentanone, bis(2-ethylhexyl)phthalate, carbon tetrachloride, chloroform, ethylbenzene, methylene chloride, tetrachloroethene, vinyl choride, and pyridine affect the liver, 1,1,2-trichloroethane, cis-1,2-dichloroethene, thallium, and zinc affect the blood, 1,2-dichloroethane, 4-methyl-2-pentanone, acetone, ethyl methacrylate, ethylbenzene, toluene, and cadmium affect the kidney, xylenes, methylphenols, naphthalene, and antimony are general systemic toxicants, 1,1-dichloroethane, methylphenols, and manganese affect the central nervous system, 1,4-dichlorobenzene, 2-butanone, and phenol are developmental toxicants, acrylonitrile affects reproduction, beryllium and chromium affect the gastrointestinal system, and arsenic and silver affect the skin. Reference doses are not available for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, 1,2-dichlorpropane, n-propylbenzene, tetrahydrofuran, trichloroethene, N-nitrosodi-n-butylamine, N-nitrosopyrrolidine, o-toluidine, and alpha-BHC Dermal RfDs are not available for any of the COCs. As was the case for the carcinogenic data, dermal RfDs can be extrapolated from oral RfDs by applying an adjustment factor as appropriate. Oral RfDs were adjusted for COCs with less than 50% absorption via the ingestion route (antimony, beryllium, cadmium, chromium, manganese, and silver) to derive dermal RfDs for these COCs. Inhalation reference concentrations (RfCs) are available for thirty volatile COCs evaluated for the inhalation pathway Aroclor-1254, alpha-BHC, antimony, arsenic, beryllium, cadmium, chromium, manganese, silver, thallium, and zinc as non-volatile contaminants, were not included in the evaluation of inhalation exposures

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table G-7								
Risk Characterization Summary - Carcinogens								
Scenario Timeframe: Future **Receptor Population: Resident** **Receptor Age: Young Child/Adult**								
Medium	**Exposure Medium**	**Exposure Point**	**Chemical of Concern**	**Carcinogenic Risk**				
				Ingestion	**Inhalation**	**Dermal**	**External (Radiation)**	**Exposure Routes Total**
Soil	Upland Soil (0-10')	GSA, Upland						
			Benzo(a)anthracene	6E-05	- -	3E-05	- -	9E-05
			Benzo(a)pyrene	4E-04	- -	2E-04	- -	5E-04
			Benzo(b)fluoranthene	3E-05	- -	1E-05	- -	4E-05
			Benzo(k)fluoranthene	3E-06	- -	1E-06	- -	5E-06
			Dibenz(a,h)anthracene	6E-05	- -	3E-05	- -	9E-05
			Indeno(1,2,3-cd)pyrene	1E-05	- -	6E-06	- -	2E-05
							Upland Soil Risk Total =	8E-04
							Total Risk =	8E-04

Key

-- Route of exposure is not applicable to this medium.

GSA = Garage and Storage Area (Group 4)

This table provides risk estimates for the significant routes of exposure for the future child and adult resident at the GSA. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child's and adult's exposure to upland soil, as well as the toxicity of the COCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene). The total risk from direct exposure to contaminated upland soil at this site to a future child and adult resident at the GSA is estimated to be 8×10^{-4}. The COC contributing most to this risk level is benzo(a)pyrene in upland soil. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 8 in 10,000 of developing cancer as a result of site-related exposure to the COCs.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table G-8

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Indoor Air	FDDA	Toluene	CNS	--	2E+00	--	2E+00
			Xylenes (total)	CNS	--	2E+01	--	2E+01
							Indoor Air Hazard Index Total =	3E+01
							CNS Hazard Index =	3E+01

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

FDDA = Former Drum Disposal Area (Group 3)

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future adjacent resident exposed to groundwater that may impact indoor air via vapor intrusion. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated target organ HI of 30 indicates that the potential for adverse effects could occur from exposure to indoor air containing toluene and xylenes.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table G-9

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Potable Groundwater	Beneath Landfill Lobes (Groups 1 & 2)	1,2-Dichloroethane	1E-05	5E-05	4E-07	--	6E-05
			1,2-Dichloropropane	4E-06	N/A	3E-07	--	4E-06
			1,4-Dichlorobenzene	4E-06	N/A	2E-06	--	7E-06
			1,4-Dioxane	2E-04	6E-05	4E-07	--	2E-04
			Benzene	3E-05	1E-04	4E-06	--	1E-04
			Chloroform	9E-07	1E-05	6E-08	--	1E-05
			Methylene chloride	3E-04	3E-04	8E-06	--	6E-04
			Tetrachloroethene	2E-04	3E-05	7E-05	--	3E-04
			Trichloroethene	5E-04	5E-05	7E-05	--	6E-04
			Vinyl Chloride	9E-04	1E-04	4E-05	--	1E-03
			N-Nitrosodi-n-butylamine	1E-04	3E-04	5E-06	--	4E-04
			N-Nitrosopyrrolidine	3E-04	5E-07	2E-06	--	3E-04
			o-Toluidine	1E-05	N/A	4E-07	--	1E-05
			Arsenic	5E-02	--	2E-04	--	5E-02
							Groundwater Risk Total =	5E-02
							Total Risk =	5E-02

Key

-- Route of exposure is not applicable to this medium.

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides risk estimates for the significant routes of exposure for the future child and adult resident exposed to groundwater used as household water should groundwater COCs migrate from beneath the landfill lobes (Groups 1 & 2). These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child's and adult's exposure to groundwater, as well as the toxicity of the COCs (1,2-dichloroethane, 1,2-dichloropropane, 1,4-dichlorobenzene, 1,4-dioxane, benzene, chloroform, methylene chloride, tetrachloroethene, trichloroethene, vinyl chloride, N-nitrosodi-n-butylamine, N-nitrosopyrrolidine, o-toluidine, and arsenic). The total risk from direct exposure to contaminated groundwater at this site to a future resident, in the event that groundwater migrates from beneath the landfill lobes, is estimated to be 5×10^{-2}. The COCs contributing most to this risk level are 1,4-dioxane, benzene, methylene chloride, tetrachloroethene, vinyl chloride, N-nitrosodi n-butylamine, N-nitrosopyrrolidine, and arsenic in groundwater. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 5 in 100 of developing cancer as a result of site-related exposure to the COCs in groundwater.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table G-10

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Potable Groundwater	Beneath Landfill Lobes (Groups 1 & 2)	1,2-Dichloroethene (total)	Liver	1E+00	3E+00	7E-02	4E+00
			2-Butanone	Developmental	4E+00	1E+00	2E-02	5E+00
			4-Methyl-2-pentanone	Liver; Kidney	1E+01	2E+00	4E-01	2E+01
			Acetone	Kidney	2E+00	2E+00	1E-02	4E+00
			Benzene	Immune System	8E-01	2E+00	7E-02	2E+00
			cis-1,2-Dichloroethene	Blood	4E+00	9E+00	2E-01	1E+01
			Ethylbenzene	Liver; Kidney	2E+00	2E+00	6E-01	5E+00
			Methylene chloride	Liver	3E+00	8E-01	6E-02	4E+00
			n-Propylbenzene	N/A	N/A	5E+00	N/A	5E+00
			Tetrahydrofuran	N/A	N/A	4E+01	N/A	4E+01
			Toluene	Kidney	2E+01	5E+00	4E+00	3E+01
			Xylenes (total)	General Toxicity	2E-01	6E+00	1E-01	6E+00
			3-/4-Methylphenol	General Toxicity; CNS	2E+01	4E+00	9E-01	2E+01
			4-Methylphenol	General Toxicity; CNS	2E+01	4E+00	1E+00	2E+01
			Naphthalene	General Toxicity	1E+00	6E+01	4E-01	6E+01
			Pyridine	Liver	4E+00	9E-01	7E-02	4E+00
			Arsenic	Skin	6E+02	--	2E+00	6E+02
			Beryllium	Gastrointestinal System	1E+00	--	5E-01	2E+00
			Cadmium	Kidney	6E+01	--	4E+00	6E+01
			Manganese	CNS	4E+01	--	3E+00	4E+01
			Thallium	Blood	5E+00	--	1E-02	5E+00
							Groundwater Hazard Index Total =	9E+02
							General Toxicity Hazard Index =	1E+02
							Developmental Hazard Index =	5E+00
							Gastrointestinal System Hazard Index =	2E+00
							Immune System Hazard Index =	2E+00
							Liver Hazard Index =	3E+01
							Kidney Hazard Index =	1E+02
							Blood Hazard Index =	2E+01
							Skin Hazard Index =	6E+02
							CNS Hazard Index =	8E+01

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future resident exposed to groundwater used as household water should groundwater COCs migrate from beneath the landfill lobes (Groups 1 & 2). The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated target organ HIs between 2 and 900 indicate that the potential for adverse effects could occur from exposure to contaminated groundwater containing 1,2-dichloroethene, 2-butanone, 4-methyl-2-pentanone, acetone, benzene, cis-1,2-dichoroethene, ethylbenzene, methylene chloride, n-propylbenzene, tetrahydrofuran, toluene, xylenes, methylphenols, naphthalene, pyridine, arsenic, beryllium, cadmium, manganese, and thallium.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table G-11

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Potable Groundwater	Outside Landfill Lobes (Groups 3-6)	1,1,2-Trichloroethane	7E-06	3E-05	5E-07	--	3E-05
			1,2-Dichloroethane	7E-05	3E-04	3E-06	--	4E-04
			1,2-Dichloropropane	4E-06	N/A	3E-07	--	4E-06
			1,4-Dichlorobenzene	1E-06	N/A	7E-07	--	2E-06
			1,4-Dioxane	5E-04	2E-04	2E-06	--	8E-04
			Acrylonitrile	1E-02	1E-02	1E-04	--	2E-02
			Benzene	4E-05	1E-04	5E-06	--	2E-04
			Carbon Tetrachloride	1E-04	2E-04	2E-05	--	4E-04
			Chloroform	3E-06	4E-05	2E-07	--	4E-05
			Methylene chloride	3E-04	3E-04	8E-06	--	6E-04
			Tetrachloroethene	5E-05	1E-05	3E-05	--	9E-05
			Trichloroethene	4E-05	4E-06	6E-06	--	5E-05
			Vinyl Chloride	2E-03	2E-04	7E-05	--	2E-03
			alpha-BHC	5E-06	--	1E-06	--	6E-06
			Aroclor-1254	8E-06	--	NE	--	8E-06
			bis(2-Ethylhexyl)phthalate	1E-04	1E-07	2E-04	--	3E-04
			Arsenic	6E-02	--	2E-04	--	6E-02
							Groundwater Risk Total =	9E-02
							Total Risk =	9E-02

Key

-- Route of exposure is not applicable to this medium.

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

NE = Not evaluated

This table provides risk estimates for the significant routes of exposure for the future child and adult residents exposed to Groups 3-6 groundwater used as household water. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a child's and adult's exposure to groundwater, as well as the toxicity of the COCs (1,1,2-trichloroethane, 1,2-dichloroethane, 1,2-dichloropropane, 1,4-dichlorobenzene, 1,4-dioxane, acrylonitrile, benzene, carbon tetrachloride, chloroform, methylene chloride, tetrachloroethene, trichloroethene, vinyl chloride, alpha-BHC, bis(2-ethylhexyl)phthalate, Aroclor-1254, and arsenic). The total risk from direct exposure to contaminated groundwater at this site to a future resident is estimated to be 9×10^{-2}. The COCs contributing most to this risk level are 1,2-dichloroethane, 1,4-dioxane, acrylonitrile, benzene, carbon tetrachloride, methylene chloride, vinyl chloride, bis(2-ethylhexyl)phthalate, and arsenic in groundwater. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 9 in 100 of developing cancer as a result of site-related exposure to the COCs in groundwater.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table G-12

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Potable Groundwater	Outside Landfill Lobes (Groups 3-6)	1,1-Dichloroethane	CNS	2E+00	8E+00	9E-02	1E+01
			1,2-Dichloroethene (total)	Liver	1E+00	3E+00	8E-02	4E+00
			1,4-Dioxane	Liver	3E+00	3E-02	7E-03	3E+00
			2-Butanone	Developmental	1E+01	3E+00	9E-02	1E+01
			4-Methyl-2-pentanone	Liver, Kidney	2E+02	3E+01	7E+00	2E+02
			Acetone	Kidney	7E+00	6E+00	5E-02	1E+01
			Acrylonitrile	Reproductive	1E+02	2E+02	8E-01	3E+02
			Benzene	Immune System	9E-01	2E+00	1E-01	3E+00
			Carbon tetrachloride	Liver	6E+00	2E+01	1E+00	3E+01
			cis-1,2-Dichloroethene	Blood	2E+00	4E+00	1E-01	6E+00
			Ethyl methacrylate	Kidney	4E+00	1E+01	5E-01	2E+01
			Ethylbenzene	Liver, Kidney	7E+00	1E+01	3E+00	2E+01
			Methylene chloride	Liver	3E+00	9E-01	9E-02	4E+00
			n-Propylbenzene	N/A	N/A	2E+00	N/A	2E+00
			Tetrahydrofuran	N/A	N/A	9E+01	N/A	9E+01
			Toluene	Kidney	8E+01	2E+01	2E+01	1E+02
			Vinyl chloride	Liver	2E+00	1E+00	8E-02	3E+00
			Xylenes (total)	General Toxicity	1E+01	3E+02	8E+00	3E+02
			2-Methylphenol	General Toxicity, CNS	2E+00	4E-02	2E-01	2E+00
			3-/4-Methylphenol	General Toxicity, CNS	4E+00	7E-01	3E-01	4E+00
			bis(2-Ethylhexyl)phthalate	Liver	3E+00	3E-03	3E+00	5E+00
			Naphthalene	General Toxicity	5E-02	3E+00	2E-02	3E+00
			Phenol	Developmental	3E+00	1E-01	2E-01	3E+00
			Aroclor-1254	Immune system	5E+00	--	NE	5E+00
			Antimony	General Toxicity	2E+01	--	7E-01	2E+01
			Arsenic	Skin	6E+02	--	3E+00	6E+02
			Beryllium	Gastrointestinal System	2E+01	--	2E+01	4E+01
			Cadmium	Kidney	1E+01	--	1E+00	1E+01
			Chromium	Gastrointestinal System	5E+00	--	1E+00	6E+00
			Manganese	CNS	5E+01	--	7E+00	6E+01
			Silver	Skin	1E+01	--	1E+00	1E+01
			Thallium	Blood	5E+00	--	3E-02	5E+00
			Zinc	Blood	2E+01	--	5E-02	2E+01
							Groundwater Hazard Index Total =	2E+03
							General Toxicity Hazard Index =	4E+02
							Developmental Hazard Index =	2E+01
							Gastrointestinal System Hazard Index =	5E+01
							Immune System Hazard Index =	8E+00
							Reproductive Hazard Index =	3E+02
							Liver Hazard Index =	3E+02
							Kidney Hazard Index =	4E+02
							Blood Hazard Index =	3E+01
							Skin Hazard Index =	7E+02
							CNS Hazard Index =	7E+01

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure

-- Route of exposure is not applicable to this medium.

NE = Not evaluated

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future resident exposed to Groups 3-6 groundwater used as household water. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated target organ HIs between 8 and 700 indicate that the potential for adverse effects could occur from exposure to contaminated groundwater containing 1,1-dichloroethane, 1,2-dichloroethene (total), 1,4-dioxane, 2-butanone, 4-methyl-2-pentanone, acetone, acrylonitrile, benzene, carbon tetrachloride, cis-1,2-dichloroethene, ethyl methacrylate, ethylbenzene, methylene chloride, n-propylbenzene, tetrahydrofuran, toluene, vinyl chloride, xylenes (total), methylphenols, bis(2-ethylhexyl)phthalate, naphthalene, phenol, Aroclor-1254, antimony, arsenic, beryllium, cadmium, chromium, manganese, silver, thallium, and zinc.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table G-13

Risk Characterization Summary - Carcinogens

Scenario Timeframe: Future
Receptor Population: Facility Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Potable Groundwater	Outside Landfill Lobes (Groups 3-6)	1,1,2-Trichloroethane	2E-06	- -	5E-08	- -	2E-06
			1,2-Dichloroethane	2E-05	- -	3E-07	- -	2E-05
			1,4-Dioxane	1E-04	- -	2E-07	- -	1E-04
			Acrylonitrile	3E-03	- -	9E-06	- -	3E-03
			Benzene	1E-05	- -	5E-07	- -	1E-05
			Carbon Tetrachloride	3E-05	- -	2E-06	- -	3E-05
			Methylene chloride	7E-05	- -	8E-07	- -	7E-05
			Tetrachloroethene	1E-05	- -	2E-06	- -	2E-05
			Trichloroethene	1E-05	- -	5E-07	- -	1E-05
			Vinyl Chloride	2E-04	- -	3E-06	- -	2E-04
			Aroclor-1254	2E-06	- -	NE	- -	2E-06
			bis(2-Ethylhexyl)phthalate	3E-05	- -	2E-05	- -	5E-05
			Arsenic	1E-02	- -	2E-06	- -	1E-02
							Groundwater Risk Total =	2E-02
							Total Risk =	2E-02

Key

-- Route of exposure is not applicable to this medium.

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

NE = Not evaluated

This table provides risk estimates for the significant routes of exposure for future facility workers exposed to Groups 3-6 groundwater used as potable water. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of an adult worker's exposure to groundwater, as well as the toxicity of the COCs (1,1,2-trichloroethane, 1,2-dichloroethane, 1,4-dioxane, acrylonitrile, benzene, carbon tetrachloride, methylene chloride, tetrachloroethene, trichloroethene, vinyl chloride, Aroclor-1254, bis(2-ethylhexyl)phthalate, and arsenic). The total risk from direct exposure to contaminated groundwater at this site to future facility workers is estimated to be 2 x 10^{-2}. The COCs contributing most to this risk level are 1,4-dioxane, acrylonitrile, vinyl chloride, and arsenic in groundwater. This risk level indicates that if no clean-up action is taken, an individual would have an increased probability of 2 in 100 of developing cancer as a result of site-related exposure to the COCs in groundwater.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table G-14

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Facility Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Potable Groundwater	Outside Landfill Lobes (Groups 3-6)	4-Methyl-2-pentanone	Liver; Kidney	3E+01	--	4E-01	3E+01
			Acrylonitrile	Reproductive	1E+01	--	5E-02	1E+01
			Toluene	Kidney	1E+01	--	1E+00	1E+01
			Xylenes (total)	General Toxicity	2E+00	--	4E-01	2E+00
			Antimony	General Toxicity	3E+00	--	3E-03	3E+00
			Arsenic	Skin	9E+01	--	1E-02	9E+01
			Beryllium	Gastrointestinal System	3E+00	--	7E-02	3E+00
			Manganese	CNS	7E+00	--	3E-02	7E+00
			Silver	Skin	2E+00	--	4E-03	2E+00
			Zinc	Blood	2E+00	--	2E-04	2E+00
							Groundwater Hazard Index Total =	2E+02
							General Toxicity Hazard Index =	5E+00
							CNS Hazard Index =	7E+00
							Gastrointestinal System Hazard Index =	3E+00
							Liver Hazard Index =	3E+01
							Kidney Hazard Index =	4E+01
							Blood Hazard Index =	2E+00
							Skin Hazard Index =	9E+01
							Reproductive Hazard Index =	1E+01

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for future facility workers exposed to Groups 3-6 groundwater used as potable water. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated target organ HIs between 2 and 200 indicate that the potential for adverse effects could occur from exposure to contaminated groundwater containing 4-methyl-2-pentanone, acrylonitrile, toluene, xylenes, antimony, arsenic, beryllium, manganese, silver, and zinc.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

ROD RISK WORKSHEET

Table G-15

Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Future
Receptor Population: Facility Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	FDDA	Xylenes (total)	CNS	--	6E+00	--	6E+00
							Indoor Air Hazard Index Total =	6E+00
							CNS Hazard Index =	6E+00

Key

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.

FDDA = Former Drum Disposal Area (Group 3)

-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for future FDDA facility workers exposed to groundwater that may impact indoor air via vapor intrusion. The Risk Assessment Guidance (RAGS) for Superfund states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated target organ HI of 6 indicates that the potential for adverse effects could occur from exposure to indoor air containing xylenes.

Source: A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents (U.S. EPA, 1999)

Table G-16

Occurrence, Distribution, and Selection of Chemicals of Concern (COPCs)

Study Area: Sutton Brook Disposal Area Site - Upper Sutton Brook
Medium: Surface Water

Chemical[1]	Frequency of Detection	Maximum Detected Concentration (ug/L)	Location of Maximum Detected Conc.	Screening Toxicity Value (ug/L)	Screening Toxicity Value Source	HQ	COPC?[2]	Reason for Exclusion
4,4-DDT	1 / 7	0.009	SW-05 (99)	0.001	1	9	Yes	
alpha-BHC	1 / 7	0.006	SW-05 (99)	2.2	2	<1	No	BSV
1,3-Dichlorobenzene	1 / 8	1	SW-05 (99)	71	2	<1	No	BSV
bis(2-Ethylhexyl)phthalate	1 / 8	1	SW-05 (99)	3	2	<1	No	BSV
1,2,4-Trimethylbenzene	3 / 5	7.7	SW-33	77	3	<1	No	BSV
Ethylbenzene	4 / 8	12	SW-05 (99)	7.3	2	1.6	Yes	
Isopropylbenzene	2 / 5	1.16	SW-33	255	3	<1	No	BSV
n-Propylbenzene	2 / 5	1.27	SW-33	128	3	<1	No	BSV
o-Xylene	3 / 5	13.6	SW4-99	13	2	1.0	Yes	
p/m-Xylene	3 / 5	36.5	SW4-99	13	2	3	Yes	
Toluene	5 / 8	123	SW4-99	9.8	2	13	Yes	
Xylenes (total)	2 / 4	37	SW-05 (99)	13	2	3	Yes	
Barium, Dissolved	3 / 3	80	SW-33	4	2	20	Yes	
Iron, Dissolved	3 / 3	1400	SW-32 (04)	1,000	1	1.4	Yes	
Manganese, Dissolved	3 / 3	530	SW-33	120	2	4	Yes	
Zinc, Dissolved	3 / 3	32	SW-33	89	1a	<1	No	BSV

Notes:

[1] Chemicals identified in the SLERA with maximum detected concentrations exceeding screening criteria or considered bioaccumulative were evaluated in the BERA.

[2] Analytes were selected in the BERA as contaminants of potential concern (COPCs) if the maximum HQ exceeded 1.0

HQ - Hazard Quotient (ratio of the maximum detected concentration to the screening toxicity value)
COPC - Contaminant of potential concern
BSV - Below Screening Value

Screening toxcity values sources:

1. National Ambient Water Quality Criterion (NAWQC) (USEPA 1986a,b; 1987; 1992a, 1998, 2002, 2006).

1a. Metals criteria were adjusted to a site-specific hardness value of 72 mg/L as CaCO3 using equations provided in USEPA, 2006

2. Secondary Chronic Value (SCV) as presented in Suter and Tsao (1996)

3. USEPA Region 6 Ecological Screening Levels for Surface Water (freshwater)

Table G-17

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Sutton Brook Disposal Area Site - Upper Sutton Brook
Medium: Sediment

Chemical[1]	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Toxicity Value (mg/kg)	Screening Toxicity Value Source	HQ	COPC?[2]	Reason for Exclusion
4,4'-DDE	1 / 9	0.0018	SD-21 (99)	37.431	1	<1	No	BSV
Endosulfan II	1 / 9	0.0018	SD-21 (99)	0.029	1	<1	No	BSV
2-Methylphenol	1 / 9	0.24	SD-21 (99)	0.134	1	1.8	Yes	
3-/4-Methylphenol	1 / 4	1.2	SD-33 (04)	0.627	1	1.9	Yes	
Benzo(a)pyrene	1 / 9	0.44	SD-14 (99)	0.257	1	1.7	Yes	
bis(2-Ethylhexyl)phthalate	2 / 9	6.4	SD-33 (04)	11.534	1	<1	No	BSV
Di-n-octylphthalate	1 / 9	0.65	SD-33 (04)	100.213	1	<1	No	BSV
1,2,4-Trimethylbenzene	4 / 8	3	SD-22 (99)	1.287	1	2	Yes	
1,3,5-Trimethylbenzene	4 / 8	16	SD-23 (99)	1.163	1	14	Yes	
4-Methyl-2-pentanone	2 / 8	0.1	SD-21 (99)	0.043	1	2	Yes	
Acetone	4 / 8	0.72	SD-14 (99)	0.069	1	10	Yes	
Carbon disulfide	2 / 8	0.015	SD-22 (99)	0.001	1	15	Yes	
Chloroethane	3 / 8	0.085	SD-23 (99)	0.026	1	3	Yes	
Ethylbenzene	5 / 8	3.3	SD-22 (99)	0.088	1	38	Yes	
Isopropylbenzene	6 / 8	0.58	SD-32 (04)	4.855	1	<1	No	BSV
Naphthalene	5 / 9	1.5	SD-32 (04)	0.514	1	3	Yes	
n-Butylbenzene	1 / 8	0.13	SD-33 (04)	2.913	1	<1	No	BSV
n-Propylbenzene	6 / 8	0.69	SD-32 (04)	2.848	1	<1	No	BSV
o-Xylene	5 / 8	0.57	SD-33 (04)	0.134	1	4	Yes	
p/m-Xylene	6 / 8	10	SD-22 (99)	0.134	1	75	Yes	
p-Isopropyltoluene	4 / 8	0.14	SD-33 (04)	21.249	1	<1	No	BSV
sec-Butylbenzene	1 / 8	0.005	SD-22 (99)	3.017	1	<1	No	BSV
Toluene	5 / 9	4.8	SD-33 (04)	0.061	1	79	Yes	
Arsenic	10 / 10	767	SD-15 (99)	8.2	2	94	Yes	
Cadmium	2 / 10	0.44	SD-33 (04)	1.2	3	<1	No	BSV

Table G-17

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Sutton Brook Disposal Area Site - Upper Sutton Brook
Medium: Sediment

Chemical[1]	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Toxicity Value (mg/kg)	Screening Toxicity Value Source	HQ	COPC?[2]	Reason for Exclusion
Iron	10 / 10	85300	SD-15 (99)	20000	4	4	Yes	
Lead	8 / 10	120	SD-33 (04)	46.7	3	3	No	AVS/SEM
Manganese	10 / 10	550	SD-33 (04)	460	4	1.2	Yes	
Mercury	1 / 10	0.11	SD-15 (99)	0.15	3	<1	No	BSV
Zinc	9 / 10	240	SD-33 (04)	150	3	1.6	No	AVS/SEM

Notes:

[1] Chemicals identified in the SLERA with maximum detected concentrations exceeding screening criteria or considered bioaccumulative were evaluated in the BERA.

[2] Analytes were selected in the BERA as contaminants of potential concern (COPCs) if the maximum HQ exceeded 1.0

HQ - Hazard Quotient (ratio of the maximum detected concentration to the screening toxicity value).
BSV - below screening value
AVS/SEM - Shown by AVS/SEM methods to not be bioavailable at this site
COPC - Contaminant of potential concern

Screening toxcity values sources:

1. Calculated by equilibrium partitioning as per USEPA, 1993, based on TOC of 2.33%.
2. USEPA Region 6 Ecological Screening Levels for Sediment
3. NOAA Effects Range-Low (ERL) (Buchman, M.R., 1999)
4. Ontario Ministry of Environment and Energy Lowest Effect Level (LEL) (OME, 1996)

Table G-18

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Sutton Brook Disposal Area Site - Aquatic Wetland
Medium: Surface Water

Chemical[1]	Frequency of Detection	Maximum Detected Concentration (ug/L)	Location of Maximum Detected Conc.	Screening Toxicity Value (ug/L)	Screening Toxicity Value Source	Amphib. Screening Criterion (ug/L)	Amphib. Screening Criterion Source	Max. HQ[2]	COPC?[3]	Reason for Exclusion
Endosulfan I	1 / 12	0.004	SW-02 (99)	0.056	1	NA	NA	<1	No	BSV
bis(2-Ethylhexyl)phthalate	1 / 15	1	SW-02 (99)	3	2	NA	NA	<1	No	BSV
1,2,4-Trimethylbenzene	5 / 18	7.44	SW3-99	77	3	NA	NA	<1	No	BSV
Ethylbenzene	6 / 21	7.94	SW3-99	7.3	2	NA	NA	1.1	Yes	
Isopropylbenzene	2 / 18	0.66	SW-110 (05)	255	3	NA	NA	<1	No	BSV
n-Propylbenzene	1 / 18	0.47	SW-35 (04)	128	3	NA	NA	<1	No	BSV
Toluene	12 / 21	72	SW-08 (99)	9.8	2	68	4	7	Yes	
Xylenes (total)	5 / 6	33	SW-08 (99)	13	2	1070	4	3	Yes	
Aluminum, Dissolved	1 / 14	220	SW-108 (05)	87	1	10	4	22	Yes	
Arsenic, Dissolved	8 / 14	20.6	SW-35 (04)	150	1	10	4	2	Yes	
Barium, Dissolved	14 / 14	140	SW-110 (05)	4	2	766	4	35	Yes	
Copper, Dissolved	3 / 14	4	SW-101 (05)	7	1*	3	4	1.3	Yes	
Iron, Dissolved	14 / 14	5300	SW-101 (05)	1,000	1	300	4	18	Yes	
Lead, Dissolved	1 / 14	5	SW-108 (05)	2	1*	8	4	3	Yes	
Manganese, Dissolved	14 / 14	980	SW-110 (05)	120	2	14.2	5	69	Yes	
Mercury, Dissolved	3 / 14	0.1	SW-110 (05)	0.77	1	1	4	<1	No	BSV
Nickel, Dissolved	12 / 14	8.8	SW-110 (05)	39	1*	3	4	3	Yes	
Zinc, Dissolved	3 / 14	38	SW-36	89	1*	3	4	13	Yes	

Notes:

[1] Chemicals identified in the SLERA with maximum detected concentrations exceeding screening criteria or considered bioaccumulative were evaluated in the BERA.

[2] Maximum HQ is the higher of the two Hazard Quotients calculated for surface water screening criterion or the amphibian screening criterion

[3] Analytes were selected in the BERA as contaminants of potential concern (COPCs) if the maximum HQ exceeded 1.0 for either the surface water or amphibian endpoint

COPC - Contaminant of potential concern
BSV - Below Screening Value
HQ - Hazard Quotient (ratio of the maximum detected concentration to the screening toxicity value)

Screening toxcity values sources:

1. National Ambient Water Quality Criterion (NAWQC) (USEPA 1986a,b; 1987, 1992a, 1998, 2002, 2006).

1a. Metals criteria were adjusted to a site-specific hardness value of 72 mg/L as CaCO3 using equations provided in USEPA, 2006.

2. Secondary Chronic Value (SCV) as presented in Suter and Tsao (1996)
3. USEPA Region 6 Ecological Screening Levels for Surface Water (freshwater)
4. Westerman, et al. 2003. Values shown are geometric mean of LC10 values
5. Birge, et al. 2000. LC50 value of 1.42 divided by 100 for NOEL use.

Table G-19

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Sutton Brook Disposal Area Site - Aquatic Wetland
Medium: Sediment

Chemical[1]	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Toxicity Value (mg/kg)	Screening Toxicity Value Source	HQ	COPC?[2]	Reason for Exclusion
4,4'-DDD	2 / 14	0.012	SD-16 (99)	0.427	1	<1	No	BSV
4,4'-DDE	3 / 14	0.0066	SD-24 (99)	408.051	1	<1	No	BSV
Benzo(a)pyrene	1/ 14	0.53	SD-01 (99)	2.798	1	<1	No	BSV
BenzoicAcid	4 / 12	5.5	WS-104 (05)	0.155	1	35	Yes	
bis(2-Ethylhexyl)phthalate	4 / 16	3.8	WS-102 (05)	125.73	1	<1	No	BSV
1,2,4-Trimethylbenzene	5 / 15	0.035	SD-01 (99)	14.035	1	<1	No	BSV
Acetone	18 / 21	2.1	WS-102 (05)	0.755	1	3	Yes	
Chloroethane	7 / 27	0.35	SD-02(99)	0.263	1	1.3	Yes	
Isopropylbenzene	5 / 16	0.35	WS-15 (04)	52.93	1	<1	No	BSV
n-Butylbenzene	1 / 13	0.023	SD-24 (99)	31.758	1	<1	No	BSV
n-Propylbenzene	3 / 14	0.075	WS-15 (04)	31.049	1	<1	No	BSV
p-Isopropyltoluene	3 / 14	0.011	WS-15 (04)	231.639	1	<1	No	BSV
sec-Butylbenzene	1 / 12	0.007	WS-15 (04)	32.887	1	<1	No	BSV
Toluene	18 / 27	8.4	SD-02(99)	0.667	1	13	Yes	
Arsenic	23 / 23	64	SD-38 (04)	8.2	2	8	Yes	
Beryllium	11 / 22	2.1	WS-11 (04)	1.1	5	2	Yes	
Cadmium	11 / 19	1.5	WS-11 (04)	1.2	3	1.3	No	AVS/SEM
Iron	22 / 22	24800	SD-01 (99)	20000	4	1.2	Yes	
Lead	22 / 22	75.6	SD-01 (99)	46.7	3	1.6	No	AVS/SEM
Mercury	8 / 20	0.22	WS-102 (05)	0.15	3	1.5	Yes	
Selenium	11 / 16	5.1	WS-11 (04)	0.72	5	7	Yes	
Zinc	14 / 17	138	SD-01 (99)	150	3	<1	No	BSV

Notes:

[1] Chemicals identified in the SLERA with maximum detected concentrations exceeding screening criteria or considered bioaccumulative were evaluated in the BERA.

[2] Analytes were selected in the BERA as contaminants of potential concern (COPCs) if the maximum HQ exceeded 1.0

HQ - Hazard Quotient (ratio of the maximum detected concentration to the screening toxicity value).
BSV - below screening value
AVS/SEM - Shown by AVS/SEM methods to not be bioavailable at this site
COPC - Contaminant of potential concern

Screening toxcity values sources:

1. Calculated by equilibrium partitioning as per USEPA, 1993, based on TOC of 25.4%.
2. USEPA Region 6 Ecological Screening Levels for Sediment
3. NOAA Effects Range-Low (ERL) (Buchman, M.R., 1999)
4. Ontario Ministry of Environment and Energy Lowest Effect Level (LEL) (OME, 1996)
5. Crommentuijn, 2000. Negligible effect concentration.

Table G-20

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Sutton Brook Disposal Area Site
Medium: Wetland Soil

Chemical[1]	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Toxicity Value (mg/kg)	Screening Toxicity Value Source	HQ	COPC?[2]	Reason for Exclusion
4,4'-DDD	2 / 9	0.044	SS-13 (04)	0.758	3	<1	No	BSV
4,4'-DDE	2 / 9	0.0381	SS-13 (04)	0.596	3	<1	No	BSV
4,4'-DDT	1 / 8	0.00602	SS-13 (04)	0.0035	3	1.7	No	**
Aldrin	1 / 9	0.0051	SD-12 (99)	0.0032	3	1.6	Yes	
Benzo(a)anthracene	1 / 9	1.2	SD-12 (99)	1.2	6	1.0	No	BSV
Benzo(a)pyrene	1 / 9	1.2	SD-12 (99)	1.2	6	1.0	No	BSV
Benzo(b)fluoranthene	1 / 9	1.7	SD-12 (99)	1.2	6	1.4	Yes	
Benzo(g,h,i)perylene	1 / 9	0.82	SD-12 (99)	1.2	6	<1	No	BSV
Benzo(k)fluoranthene	1 / 9	0.58	SD-12 (99)	1.2	6	<1	No	BSV
Benzoic Acid	2 / 8	0.78	SS-9 (04)	0.035	4	22	Yes	
bis(2-Ethylhexyl)phthalate	1 / 9	0.29	SS-13 (04)	100	5	<1	No	BSV
Chrysene	1 / 9	1.4	SD-12 (99)	1.2	3	1.2	Yes	
Fluoranthene	1 / 9	2.6	SD-12 (99)	1.2	6	2	Yes	
Indeno(1,2,3-cd)pyrene	1 / 9	0.86	SD-12 (99)	1.2	6	<1	No	BSV
Perylene	1 / 8	0.25	SS-9 (04)	1.2	6	<1	No	BSV
Phenanthrene	1 / 9	1.5	SD-12 (99)	1.2	6	1.3	Yes	
Pyrene	1 / 9	2.3	SD-12 (99)	1.2	6	1.9	Yes	
2-Hexanone	1 / 8	0.0027	GP-23 (04)	89	3	<1	No	BSV
p-Isopropyltoluene	1 / 8	0.01	GP-8 (04)	52	4	<1	No	BSV
Arsenic	12 / 12	30	SS-9 (04)	18	1	1.7	Yes	
Cadmium	7 / 12	1.2	WS-106 (05)	0.77	1	1.6	No	**
Lead	12 / 12	104	SD-12 (99)	56	1	1.9	No	**
Manganese	12 / 12	1000	WS-107 (05)	415	7	2	Yes	
Mercury	10 / 12	0.3	WS-106 (05)	0.00051	2	588	Yes	
Selenium	9 / 12	2.4	WS-106 (05)	0.21	2	11	Yes	
Vanadium	12 / 12	16.1	SD-13 (99)	2	5	8	Yes	
Zinc	12 / 12	76.9	SD-12 (99)	120	1	<1	No	BSV

Notes:

[1] Chemicals identified in the SLERA with maximum detected concentrations exceeding screening criteria or considered bioaccumulative were evaluated in the BERA.

[2] Analytes were selected in the BERA as contaminants of potential concern (COPCs) if the maximum HQ exceeded 1.0, except for analytes designated with "**" under Reason for Exclusion. These analytes were evaluated further in the SLERA utilizing site-specific modeling; comparison to receptor-specific benchmarks resulted in HQs below 1.0.

BSV - below screening value
COPC - Contaminant of potential concern
HQ - Hazard Quotient (ratio of the maximum detected concentration to the screening toxicity value).

Screening toxcity values sources:

1 USEPA Ecological Soil Screening Levels (Eco-SSLs) (USEPA, 2003, 2005) Lowest value listed. 2nd-lowest value for cadmium and lead are shown, since lowest value is below 50th percentile of US background concentrations. Value for zinc is draft.
2. Oak Ridge National Laboratory, 1997. Preliminary Remediation Goals for Ecological Endpoints This document lists the lowest value for wildlife, plant, and invertebrates.
3. EPA Region 5, 2003. Ecological Screening Levels. Most of these values are based on bioaccumulation.
4. No benchmarks available. Sediment value used.
5 Efroymson, R.A., et al. 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision Oak Ridge National Laboratory, Oak Ridge, Tennessee.
6 USEPA, 1999. Screening Level Ecological Risk Assessment Protocol for Waste Combustion Facilities. Draft Vol. 1-3 Appendix H-5-30 All PAHs based on benzo(a)pyrene.
7. Paschke, M.W. et al. 2005. Manganese toxicity thresholds for restoration grass species. Env. Poll 135(2) 313 322

Table G-21

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Sutton Brook Disposal Area Site - Pond
Medium: Surface Water

Chemical[1]	Frequency of Detection	Maximum Detected Concentration (ug/L)	Location of Maximum Detected Conc.	Screening Toxicity Value (ug/L)	Screening Toxicity Value Source	Amphib. Screening Criterion (ug/L)	Amphib. Screening Criterion Source	Max. HQ[2]	COPC?[3]	Reason for Exclusion
Barium, Dissolved	1 / 1	6	SW-39 (04)	4	2	766	3	1.5	Yes	
Manganese, Dissolved	1 / 1	20	SW-39 (04)	120	2	14.2	4	1.4	Yes	
Zinc, Dissolved	1 / 1	7	SW-39 (04)	15.4	1a	3	3	2	Yes	

Notes:

[1] Chemicals identified in the SLERA with maximum detected concentrations exceeding screening criteria or considered bioaccumulative were evaluated in the BERA.

[2] Maximum HQ is the higher of the two Hazard Quotients calculated for surface water screening criterion or the amphibian screening criterion

[3] Analytes were selected in the BERA as contaminants of potential concern (COPCs) if the maximum HQ exceeded 1.0 for either the surface water or amphibian endpoint

COPC - Contaminant of potential concern
BSV - Below Screening Value
HQ - Hazard Quotient (ratio of the maximum detected concentration to the screening toxicity value).

Screening toxcity values sources:

1. National Ambient Water Quality Criterion (NAWQC) (USEPA 1986a,b; 1987; 1992a, 1998, 2002, 2006).

1a. Metals criteria were adjusted to a site-specific hardness value of 72 mg/L as $CaCO_3$ using equations provided in USEPA, 2006.

2. Secondary Chronic Value (SCV) as presented in Suter and Tsao (1996)

3. Westerman, et al. 2003. Values shown are geometric mean of LC10 values

4. Birge, et al. 2000. LC50 value of 1.42 divided by 100 for NOEL use.

Table G-22

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Sutton Brook Disposal Area Site - Pond
Medium: Sediment

Chemical[1]	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Toxicity Value (mg/kg)	Screening Toxicity Value Source	HQ	COPC?[2]	Reason for Exclusion
Acetone	2 / 4	0.024	SD-42 (04)	0.0074	1	3	Yes	
Carbon disulfide	2 / 4	0.0016	SD-39 (04)	0.0001	1	16	Yes	
p-Isopropyltoluene	1 / 4	0.002	SD-39 (04)	2.28	1	<1	No	BSV
Arsenic	4 / 4	15	SD-39 (04)	8.2	2	1.8	Yes	
Lead	4 / 4	31	SD-41 (04)	46.7	3	<1	No	BSV
Zinc	4 / 4	13	SD-39 (04)	150	3	<1	No	BSV

Notes:

[1] Chemicals identified in the SLERA with maximum detected concentrations exceeding screening criteria or considered bioaccumulative were evaluated in the BERA.

[2] Analytes were selected in the BERA as contaminants of potential concern (COPCs) if the maximum HQ exceeded 1.0

HQ - Hazard Quotient (ratio of the maximum detected concentration to the screening toxicity value).

COPC - Contaminant of potential concern

BSV - below screening value

Screening toxcity values sources:

1. Calculated by equilibrium partitioning as per USEPA, 1993, based on TOC of 2.33%.
2. USEPA Region 6 Ecological Screening Levels for Sediment
3. NOAA Effects Range-Low (ERL) (Buchman, M.R., 1999)

Table G-23								
Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)								
Study Area: Sutton Brook Disposal Area Site **Medium: Upland Soil**								
Chemical[1]	**Frequency of Detection**	**Maximum Detected Concentration (mg/kg)**	**Location of Maximum Detected Conc.**	**Screening Toxicity Value (mg/kg)**	**Screening Toxicity Value Source**	**HQ**	**COPC?[2]**	**Reason for Exclusion**
4,4'-DDD	7 / 9	0.01	SO-04 (99)	0.758	3	<1	No	BSV
4,4'-DDE	7 / 9	0.0086	SO-04 (99)	0.596	3	<1	No	BSV
4,4'-DDT	1 / 2	0.014	SO-07 (99)	0.0035	3	4	Yes	
Aldrin	1 / 8	0.00041	SO-10 (99)	0.332	3	<1	No	BSV
alpha-Chlordane	1 / 7	0.002	SO-10 (99)	0.15	11	<1	No	BSV
delta-BHC	1 / 9	0.0014	SO-09 (99)	0.004	3	<1	No	BSV
Dieldrin	5 / 9	0.0056	SO-09 (99)	0.011	1	<1	No	BSV
Endosulfan II	1 / 9	0.0013	SO-08 (99)	0.06	12	<1	No	BSV
Endrin	3 / 7	0.0062	SO-09 (99)	0.0101	3	<1	No	BSV
Endrin aldehyde	4 / 6	0.0021	SO-06 (99)	0.0105	3	<1	No	BSV
Methoxychlor	5 / 9	0.017	SO-09 (99)	0.0199	3	<1	No	BSV
Aroclor-1248	5 / 9	0.11	SO-06 (99)	0.371	2	<1	No	BSV
Aroclor-1260	8 / 9	0.096	SO-04 (99)	0.371	2	<1	No	BSV
1,2,4-Trichlorobenzene	3 / 11	0.56	SO-07 (99)	0.48	9	1.2	Yes	
2,4,6-Trichlorophenol	2 / 10	0.39	SO-07 (99)	4	2	<1	No	BSV
2,4-Dimethylphenol	1 / 10	0.089	SO-07 (99)	0.01	3	9	Yes	
2,6-Dinitrotoluene	1 / 10	0.22	SO-07 (99)	0.0328	3	7	No	**
2-Chloronaphthalene	1 / 10	0.19	SO-07 (99)	0.0122	3	16	No	**
2-Methylnaphthalene	1 / 10	0.28	SO-09 (99)	1.73	10	<1	No	BSV
3,3'-Dichlorobenzidine	1 / 10	0.34	SO-08 (99)	0.0646	3	5	No	**
4,6-Dinitro-o-cresol	1 / 10	0.25	SO-07 (99)	0.15	4	1.7	Yes	
Acenaphthene	3 / 10	0.087	SO-10 (99)	1	9	<1	No	BSV
Anthracene	6 / 10	0.21	SO-07 (99)	1	9	<1	No	BSV
Benzo(a)anthracene	8 / 10	0.81	SO-09 (99)	1.2	8	<1	No	BSV
Benzo(a)pyrene	8 / 10	0.99	SO-09 (99)	1.2	8	<1	No	BSV
Benzo(b)fluoranthene	8 / 10	1.1	SO-09 (99)	1.2	8	<1	No	BSV
Benzo(g,h,i)perylene	8 / 10	0.71	SO-09 (99)	1.2	8	<1	No	BSV
Benzo(k)fluoranthene	6 / 10	0.75	SO-09 (99)	1.2	8	<1	No	BSV
bis(2-Ethylhexyl)phthalate	10 / 10	120	SB-3 (04)	100	7	1.2	Yes	Model
Butyl benzyl phthalate	6 / 10	0.66	SO-07 (99)	100	7	<1	No	BSV
Chrysene	8 / 10	0.83	SO-09 (99)	1.2	3	<1	No	BSV
Dibenz(a,h)anthracene	4 / 10	0.94	SO-09 (99)	1.2	8	<1	No	BSV
Dibenzofuran	2 / 10	0.049	SO-10 (99)	NA	NA	NA	No	NSV
Di-n-butylphthalate	4 / 10	0.43	SO-07 (99)	200	2	<1	Yes	Model
Di-n-octylphthalate	4 / 10	39	SB-3 (04)	100	7	<1	Yes	Model
Fluoranthene	8 / 10	1.2	SO-08 (99)	1.2	8	1.0	Yes	
Fluorene	2 / 10	0.077	SO-10 (99)	20	7	<1	No	BSV
Hexachlorobenzene	1 / 10	0.22	SO-07 (99)	0.199	3	1.1	No	**
Hexachlorobutadiene	3 / 11	0.55	SO-07 (99)	0.398	3	1.4	No	**
Hexachloroethane	1 / 10	0.13	SO-07 (99)	0.596	3	<1	No	BSV
Indeno(1,2,3-cd)pyrene	7 / 10	0.94	SO-09 (99)	1.2	8	<1	No	BSV
Isophorone	2 / 10	0.31	SO-07 (99)	NA	NA	NA	No	NSV
Naphthalene	4 / 11	1.4	SB-3 (04)	1	9	1.4	Yes	
Pentachlorophenol	1 / 10	0.18	SO-07 (99)	3	2	<1	No	BSV
Phenanthrene	8 / 10	0.84	SO-08 (99)	1.2	8	<1	No	BSV
Pyrene	8 / 10	1.1	SO-10 (99)	1.2	8	<1	No	BSV
1,2,4-Trimethylbenzene	1 / 2	6.3	SB-3 (04)	1.06	10	6	Yes	FDDA
1,3,5-Trimethylbenzene	1 / 2	2.4	SB-3 (04)	1.06	10	2	Yes	FDDA

Table G-23

Occurrence, Distribution, and Selection of Chemicals of Potential Concern (COPCs)

Study Area: Sutton Brook Disposal Area Site
Medium: Upland Soil

Chemical[1]	Frequency of Detection	Maximum Detected Concentration (mg/kg)	Location of Maximum Detected Conc.	Screening Toxicity Value (mg/kg)	Screening Toxicity Value Source	HQ	COPC?[2]	Reason for Exclusion
Ethylbenzene	2 / 11	6.2	SB-3 (04)	3.2	9	1.9	Yes	FDDA
Isopropylbenzene	1 / 2	0.35	SB-3 (04)	1.06	10	<1	No	BSV
n-Butylbenzene	1 / 2	0.73	SB-3 (04)	1.06	10	<1	No	BSV
n-Propylbenzene	1 / 2	0.7	SB-3 (04)	1.06	10	<1	No	BSV
o-Xylene	1 / 11	4.6	SB-3 (04)	1.06	10	4	Yes	FDDA
p/m-Xylene	2 / 11	20	SB-3 (04)	1.06	10	19	Yes	FDDA
Xylene (total)	1/8	0.88	SO-09 (99)	1.06	10	<1	Yes	Model
p-Isopropyltoluene	1 / 2	0.37	SB-3 (04)	52	5	<1	No	BSV
Toluene	4 / 11	6.5	SB-3 (04)	1.06	10	6	Yes	FDDA
Cadmium	6 / 11	0.63	SO-05 (99)	0.77	1	<1	No	BSV
Chromium	11 / 11	28.3	SO-05 (99)	26	1	1.1	Yes	
Copper	11 / 11	88.3	SO-01 (99)	50	6	1.8	Yes	
Lead	11 / 11	233	SO-01 (99)	56	1	4	Yes	
Mercury	2 / 11	0.26	SB-7 (04)	0.00051	2	510	Yes	
Vanadium	11 / 11	18	SO-07 (99)	2	7	9	Yes	
Zinc	11 / 11	379	SO-07 (99)	120	1	3	Yes	

Notes:

[1] Chemicals identified in the SLERA with maximum detected concentrations exceeding screening criteria or considered bioaccumulative were evaluated in the BERA.

[2] Analytes were selected in the BERA as contaminants of potential concern (COPCs) if the maximum HQ exceeded 1.0, except for analytes designated with "**" under Reason for Exclusion. These analytes were evaluated further in the SLERA utilizing site-specific modeling; comparison to receptor-specific benchmarks resulted in HQs below 1.0.

HQ - Hazard Quotient (ratio of the maximum detected concentration to the screening toxicity value).
BSV - below screening value
COPC - Contaminant of potential concern
FDDA - Chemical selected as COPC in Former Drum Disposal Area
NSV - No screening value available; low detection frequency and low observed concentrations
Model - Selection of COPC is based on SLERA calculation of modeled maximum exposure to a carnivore (robin)

1. USEPA Ecological Soil Screening Levels (Eco-SSLs) (USEPA, 2003, 2005). Lowest value listed. 2nd-lowest value for cadmium and lead are shown, since lowest value is below 50th percentile of US background concentrations. Values for zinc and dieldrin are draft.
2. Oak Ridge National Laboratory, 1997. Preliminary Remediation Goals for Ecological Endpoints. This document lists the lowest value for wildlife, plant, and invertebrates.
3. EPA Region 5, 2003. Ecological Screening Levels. Most of these values are based on bioaccumulation.
4. No benchmark available. Value based on 15 mg/kg LC50 for earthworms reported in the Hazardous Substance Database.
5. No benchmarks available. Sediment value used.
6. Efroymson, R.A., et al. 1997. Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Process: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, Tennessee.
7. Efroymson, R.A., et al. 1997. Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision. Oak Ridge National Laboratory, Oak Ridge, Tennessee
8. USEPA, 1999. Screening Level Ecological Risk Assessment Protocol for Waste Combustion Facilities. Draft. Vol. 1-3 Appendix H-5-30 All PAHs based on benzo(a)pyrene.
9. Hulsebos, E.M. et al. 1993. Phytotoxicity studies with Lactuca sativa in soil and nutrient solution. Env. Tox. Chem. 12(6):1079-1094. EC50 values divided by 100 for NOAEL use. Ethylbenzene value based on styrene.
10. Neuhauser, R. et al. 1985. The toxicity of selected organic chemicals to the earthworm Eisenia fetida. J Environ. Qual. 14(3): 383-388. Study LC50s divided by 100 for NOAEL use. Values for alkylated benzenes are based on carbaryl, worm toxicities similar.
11. Calculated from lowest Ecotox value
12. Dutch Soil Intervention value, as cited by the Risk Assessment Information Sytemn (RAIS). endosulfan value based on endrin.

Table G-24

Ecological Exposure Pathways of Concern

Exposure Media	Sensitive Environment Flag Y or N	Receptor	Endangered/ Threatened Species Flag Y or N	Exposure Routes	Assessment Endpoints	Measurement Endpoints
UPPER SUTTON BROOK HABITAT AREA						
Sediment	N	Benthic Invertebrates	N	Ingestion and direct contact with chemicals in sediment	Survival and growth of local populations of benthic invertebrates	- Comparison of sediment COPC concentrations to benchmarks - Toxicity of sediment to *Hyalella azteca* and *Chironomus tentans* in the Southern Tributary
Surface water	N	Pelegic invertebrates and fish populations	N	Ingestion and direct contact with chemicals in surface water	Survival and growth of potential fish and invertebrate communities	- Comparison of surface water COPC concentrations to criteria/benchmarks
AQUATIC WETLAND						
Sediment	N	Benthic Invertebrates	N	Ingestion and direct contact with chemicals in sediment	Survival and growth of of benthic invertebrates communities	- Comparison of sediment COPC concentrations to benchmarks
Surface water	N	Pelegic invertebrates and amphibians	N	Ingestion and direct contact with chemicals in surface water	Survival and growth of potential amphibian and invertebrate communities	- Comparison of surface water COPC concentrations to criteria/benchmarks
Surface water, sediment, biota	N	Avian wildlife species (carnivore, omnivore, herbivore)	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of avian wildlife	- Comparison of estimated dietary doses in avian wildlife with TRVs
SITE POND						
Sediment	N	Benthic Invertebrates	N	Ingestion and direct contact with chemicals in sediment	Survival and growth of benthic invertebrates communities	- Comparison of sediment COPC concentrations to benchmarks
Surface water	N	Pelegic invertebrates and amphibians	N	Ingestion and direct contact with chemicals in surface water	Survival and growth of potential amphibian and invertebrate communities	- Comparison of surface water COPC concentrations to criteria/benchmarks
Surface water, sediment, biota	N	Avian wildlife species (carnivore, omnivore, herbivore)	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of avian wildlife	- Comparison of estimated dietary doses in avian wildlife with TRVs
WETLAND SOILS						
Wetland Soils	N	Terrestrial Plants	N	Uptake of chemicals in wetland soils	Diversity and abundance of terrestrial plants	- Comparison of soil COPC concentrations to benchmarks
Wetland Soils	N	Terrestrial Invertebrates	N	Ingestion and direct contact with chemicals in soil	Survival and growth of terrestrial invertebrates communities	- Comparison of soil COPC concentrations to benchmarks
Wetland Soils	N	Wetland carnivorous wildlife (Shrew)	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of carnivorous wildlife	- Comparison of estimated dietary doses in carnivorous wildlife with TRVs
Wetland Soils	N	Wetland herbivorous wildlife (Rabbit)	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of herbivorous wildlife	- Comparison of estimated dietary doses in herbivorous wildlife with TRVs
UPLAND SOILS						
Upland Soils	N	Terrestrial Plants	N	Uptake of chemicals in upland soils	Diversity and abundance of terrestrial plants	- Comparison of soil COPC concentrations to benchmarks
Upland Soils	N	Terrestrial Invertebrates	N	Ingestion and direct contact with chemicals in soil	Survival and growth of terrestrial invertebrates communities	- Comparison of soil COPC concentrations to benchmarks
Upland Soils	N	Terrestrial carnivorous wildlife (Robin)	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of carnivorous wildlife	- Comparison of estimated dietary doses in carnivorous wildlife with TRVs
Upland Soils	N	Terrestrial carnivorous wildlife (Meadow Vole)	N	Dietary exposures of COPCs	Sustainability (survival, growth, reproduction) of local populations of carnivorous wildlife	- Comparison of estimated dietary doses in carnivorous wildlife with TRVs

Notes:

COPC - Chemical of Potential Concern

TRVs - Toxicity reference values

Table G-25

COC Concentrations Expected to Provide Adequate Protection of Ecological Receptors

Habitat Type/Name	Exposure Medium	COC	Protective Level	Units	Basis	Assessment Endpoint
Upper Sutton Brook - Site Channel	Sediment	1,2,4-Trimethylbenzene	1.3	mg/kg	Site-Specific NOAEL	- Survival and growth of local populations of benthic invertebrates
		1,3,5-Trimethylbenzene	1.2	mg/kg	Site-Specific NOAEL	
		2-Methylphenol	0.1	mg/kg	Site-Specific NOAEL	
		3-/4-Methylphenol	0.6	mg/kg	Site-Specific NOAEL	
		4-Methyl-2-pentanone	0.04	mg/kg	Site-Specific NOAEL	
		Acetone	0.07	mg/kg	Site-Specific NOAEL	
		Carbon Disulfide	0.001	mg/kg	Site-Specific NOAEL	
		Chloroethane	0.03	mg/kg	Site-Specific NOAEL	
		Ethylbenzene	0.09	mg/kg	Site-Specific NOAEL	
		Toluene	0.06	mg/kg	Site-Specific NOAEL	
		Xylenes (total)	0.13	mg/kg	Site-Specific NOAEL	
Upper Sutton Brook - Site Channel	Surface Water	4,4'-DDT	0.001	ug/L	NRWQC	- Survival and growth of potential fish and invertebrate communities
		Ethylbenzene	7.3	ug/L	Site-Specific NOAEL	
		Toluene	9.8	ug/L	Site-Specific NOAEL	
		Xylenes (total)	13	ug/L	Site-Specific NOAEL	
Former Drum Disposal Area	Soil	1,2,4-Trimethylbenzene	1.1	mg/kg	Site-Specific NOAEL	- Sustainability (survival, growth, reproduction) of local populations of carnivorous wildlife (robin) - survival and growth of invertebrtates - abundance and diversity of plants
		1,3,5-Trimethylbenzene	1.1	mg/kg	Site-Specific NOAEL	
		bis(2-Ethylhexyl)phthalate	2.3	mg/kg	HQ = 0.1	
		Di-n-octylphthalate	0.1	mg/kg	HQ = 0.1	
		Ethylbenzene	1.1	mg/kg	Site-Specific NOAEL	
		Naphthalene	1	mg/kg	Site-Specific NOAEL	
		Toluene	1.1	mg/kg	Site-Specific NOAEL	
		Xylenes (total)	1.1	mg/kg	Site-Specific NOAEL	
Garage and Storage Area	Soil	Di-n-octylphthalate	0.4	mg/kg	HQ = 0.1	- Sustainability (survival, growth, reproduction) of local populations of carnivorous wildlife (robin) - survival and growth of invertebrtates
		Lead	65	mg/kg	HQ = 0.1	
		Zinc	190	mg/kg	Site-Specific LOAEL	

Notes:

HQ - Hazard Quotient
NOAEL - No Observable Adverse Effect Level
COC - Chemical of Concern
LOAEL - Lowest Observable Adverse Effect Level
NRWQC - National Recommended Water Quality Criterion

TABLE LF-1
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA
Table LF-1: No Action

EVALUATION CRITERIA	DETAILED ANALYSIS
Type and Quantity of Residuals Remaining after Treatment	Existing conditions will remain since no treatment is proposed.
Degree to Which Treatment Reduces Principal Threats	No treatment is proposed.
	SHORT-TERM EFFECTIVENESS
Protection of Community During Remedial Action	Not applicable since no remedial actions are included in this alternative.
Protection of Workers During Remedial Action	Not applicable since no remedial actions are included in this alternative.
Environmental Impacts	Not applicable since no remedial actions are included in this alternative.
Time Until Remedial Action Objectives are Achieved	No active remedial actions will be implemented to contain the landfill waste or to reduce concentrations in sediment, surface water or groundwater to cleanup goals. Therefore, RAO's will not be achieved through this alternative in the foreseeable future.
	[illegible]
Ability to Construct and Operate the Technology	Not applicable since no remedial actions are included in this alternative.
Reliability of the Technology	Not applicable since no remedial actions are included in this alternative.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Not applicable since no remedial actions or monitoring are included in this alternative.
Ability to Obtain Approvals and Coordinate with Other Agencies	Not applicable since no remedial actions are included in this alternative; therefore, no approvals or coordination required.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Not applicable for this alternative.
Availability of Necessary Equipment and Specialists	No equipment or specialists required for this alternative.
Availability of Technology	Not applicable since no remedial technologies will be used.
	COSTS - *net present value (7%) - 30 years*
Capital Costs	$0
Annual Operation, Maintenance and Monitoring	$68,000
Periodic Costs	$43,000
TOTAL	$111,000

TABLE LF-2a
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-2a: Containment of waste, vent landfill gas, restoration of wetlands and brook, containment of groundwater with a vertical barrier and groundwater remediation

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The HHRA presumed that the Northern and Southern landfill lobes will be capped; thereby eliminating direct exposure to soils located in these areas. The results of the HHRA concluded if groundwater is used as a source of potable water, groundwater may also pose a risk to hypothetical future site residents or workers. Under this alternative, the landfill waste will be capped and impacted groundwater immediately downgradient of the Southern lobe will be prevented from discharging into the brook (preventing migration and potential re-contamination of the brook), sediments within the brook will be excavated, and in-situ natural attenuation mechanisms will be monitored to address groundwater impacts. In conjunction with institutional controls, future risk of groundwater ingestion by site users will be controlled, therefore the site RAOs will be achieved.
Ecological Protection	The results of the ecological risk assessment indicated that VOCs and/or metals in sediment and surface water within Sutton Brook between the two landfill lobes may pose a potential risk to ecological receptors. Due to these potential risks, PRGs were established for the specific constituents determined to be "risk drivers" in sediment and surface water. Under this alternative, the landfill waste will be capped, the Southern lobe impacted groundwater will be controlled, minimizing discharge to the brook (preventing potential re-contamination of the brook sediment/surface water) and excavation of the impacted sediment will be conducted to reduce concentrations to meet RAOs.
COMPLIANCE WITH ARARs	
Chemical Specific	Potential chemical specific ARARs for this alternative are presented in Table E-1 in Appendix E; this alternative will be designed and implemented to comply with applicable chemical-specific ARARs.
Location Specific	Potential location specific ARARs for this alternative are presented in Table E-1 in Appendix E; this alternative will be designed and implemented to comply with applicable location-specific ARARs.
Action Specific	Action specific ARARs for this alternative are presented in Table E-1 in Appendix E; this alternative will be designed and implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	With the construction of a final cover system over the landfill lobes and the excavation of impacted sediment from the brook, the residual risks for direct exposure of landfill waste and impacted sediment are eliminated. However, given the potential for some wastes to have been placed near or at the water table surface, the potential will remain for some leaching of contaminants from the waste into groundwater. Prevention of further impacts to the brook through groundwater containment and natural attenuation mechanisms will minimize future residual risk to re-contaminating the brook sediment and/or surface water. In conjunction with institutional controls, future risk of groundwater ingestion by site users will be controlled. Therefore, residual risk is low for this alternative.

TABLE LF-2a
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-2a: Containment of waste, vent landfill gas, restoration of wetlands and brook, containment of groundwater with a vertical barrier and groundwater remediation

EVALUATION CRITERIA	DETAILED ANALYSIS
Adequacy and Reliability of Controls	Capping of the landfill waste is an effective and reliable technology to prevent exposure to the waste and to reduce infiltration through the waste and leaching to groundwater. The combination of groundwater containment (via a vertical barrier), natural attenuation mechanisms, and institutional controls will effectively and reliably limit human exposure to impacted groundwater until groundwater RAOs are met. Monitoring of the containment system and natural attenuation mechanisms will be required to demonstrate reliability.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	This alternative does not treat the landfill waste. Treatment of the excavated sediment is not anticipated prior to on-site disposal beneath the landfill final cover system; however, if deemed necessary based on the pre-design waste characterization results of the material being excavated, ex-situ treatment of soil may be implemented prior to on-site disposal. This alternative does not actively treat groundwater. Monitored natural attenuation processes will address COCs in situ. Following the phased approach, this alternative may also include an active groundwater treatment component.
Amount Destroyed or Treated	The landfill waste and excavated sediment are not anticipated to be treated. Groundwater will be addressed with natural attenuation processes. Current dissolved concentrations indicate an estimated 2,700 to 4,500 lbs of VOCs in Northern and Southern lobe groundwater.
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	Compared to the other alternatives evaluated for the landfill lobes, this alternative provides a low level of reduction in toxicity, mobility and volume of contaminants through treatment.
Degree to which Treatment is Irreversible	This alternative does not include active treatment technologies.
Type and Quantity of Residuals Remaining after Treatment	This alternative does not treat the landfill waste. Through excavation of the impacted sediment, no residuals presenting exposure risks will remain. This alternative does not actively treat groundwater. Monitored natural attenuation processes will address COCs in situ.
Degree to Which Treatment Reduces Principal Threats	Principal threats of direct exposure and potential leaching from waste to groundwater are addressed via landfill containment (cap). The principal threats/ exposure risks of groundwater migration and ingestion will be controlled/reduced through groundwater containment (via vertical barrier), natural attenuation, and institutional controls.

TABLE LF-2a
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-2a: Containment of waste, vent landfill gas, restoration of wetlands and brook, containment of groundwater with a vertical barrier and groundwater remediation

EVALUATION CRITERIA	DETAILED ANALYSIS
	SHORT-TERM EFFECTIVENESS
Protection of Community During Remedial Action	This alternative will have moderate short-term effects on the local community during the construction of the landfill final cover system due to an increase in local truck/ vehicular traffic (bringing in soil cover material). Limited short term effects are anticipated as a result of the sediment excavation or groundwater MNA portions of this alternative.
Protection of Workers During Remedial Action	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.
Environmental Impacts	Impacts to the wetland resource areas are anticipated to be low to moderate during construction activities due to the location of the wetland resource areas surrounding the landfill lobes (erosion controls and stormwater management will be required to reduce impacts) and during the brook excavation, temporary re-directing/routing of the brook may be required to effectively remove the impacted sediment, potentially causing disruption to the existing ecological habitat. Once the landfill capping and brook excavation are complete and the area restored, operation and monitoring activities are anticipated to have minimal impacts. Available practical means such as erosion and stormwater control measures will also be implemented to minimize harm to wetland areas during construction.
Time Until Remedial Action Objectives are Achieved	Landfill waste RAOs will be achieved upon construction of the final cover system (design/approvals 1 year, construction 2 to 3 years) and the sediment RAOs will be achieved upon removal of the impacted sediment (confirmatory sediment sampling will be performed to document the achievement of RAOs) - (design/approvals - 1 year, construction/restoration 1 to 1.5 years). The estimated time to achieve groundwater RAOs is approximately 65 to 210 years
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	Construction of the landfill final cover system is a common technique that is straight forward to implement; the presence of wetland resource areas and the adjacent 100-year flood plain may present potential design challenges (stormwater management, etc.). Preliminary evaluation of stormwater/ drainage features at the site indicate that upon capping the landfill, use of the FDDA and Deep Marsh may be required for stormwater detention ponds. Excavation of impacted sediment from existing waterways is a fairly common construction activity; site specific engineering and erosion controls will be required to minimize environmental impacts. The installation of a vertical containment barrier involves common construction techniques. This alternative requires a lower level of operation, maintenance, and monitoring than other alternatives evaluated (e.g. LF-3).
Reliability of the Technology	Excavation of impacted sediment is an effective and reliable method since the material will be removed. Capping of the landfill waste is an effective and reliable technology to prevent direct exposure to the waste and to reduce infiltration through the waste into groundwater. The combination of groundwater containment (via a vertical barrier), natural attenuation, and institutional controls should effectively and reliably limit human exposure to impacted groundwater until groundwater RAOs are met.

TABLE LF-2a
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-2a: Containment of waste, vent landfill gas, restoration of wetlands and brook, containment of groundwater with a vertical barrier and groundwater remediation

EVALUATION CRITERIA	DETAILED ANALYSIS
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative should not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Confirmatory sediment sampling and analysis is easily implementable to measure the effectiveness of the brook sediment excavation. Groundwater monitoring to demonstrate contaminant containment and mass reduction is easily implementable.
Ability to Obtain Approvals and Coordinate with Other Agencies	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Facilities are available to treat or dispose of the excavated sediment within Massachusetts. However, there is also availability to re-use this material on-site at one of the landfill lobes beneath the final cover system.
Availability of Necessary Equipment and Specialists	Equipment, materials and services for this alternative are readily available.
Availability of Technology	Qualified engineers and contractors are available to design and implement this alternative.
	COSTS - *net present value (7%) - 30 years*
	LF-2a
Capital Costs	$17,500,000
Annual Operation, Maintenance and Monitoring	$2,900,000
Periodic Costs	$120,000
TOTAL	$20,520,000

TABLE LF-2b
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-2b: Containment of waste, vent landfill gas, restoration of wetlands and brook, containment of groundwater with a vertical barrier and groundwater remediation

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The HHRA presumed that the Northern and Southern landfill lobes will be capped; thereby eliminating direct exposure to soils located in these areas. The results of the HHRA concluded if groundwater is used as a source of potable water, groundwater may also pose a risk to hypothetical future site residents or workers. Under this alternative, the landfill waste will be capped, sediments within the brook will be excavated, impacted groundwater immediately downgradient of the Southern lobe will be treated and prevented from discharging into the brook (preventing migration and potential re-contamination of the brook) and impacted groundwater from the Northern lobe will be addressed by in-situ natural attenuation. In conjunction with institutional controls, future risk of groundwater ingestion by site users will be controlled, therefore the site RAOs will be achieved.
Ecological Protection	The results of the ecological risk assessment indicated that VOCs and/or metals in sediment and surface water within Sutton Brook between the two landfill lobes may pose a potential risk to ecological receptors. Due to these potential risks, PRGs were established for the specific constituents determined to be "risk drivers" in sediment and surface water. Under this alternative, the landfill waste will be capped, the Southern lobe impacted groundwater will be controlled, minimizing discharge to the brook (preventing potential re-contamination of the brook sediment/surface water) and excavation of the impacted sediment will be conducted to reduce concentrations to meet RAOs.
COMPLIANCE WITH ARARs	
Chemical Specific	Potential chemical specific ARARs for this alternative are presented in Table E-1 in Appendix E; this alternative will be designed and implemented to comply with applicable chemical-specific ARARs.
Location Specific	Potential location specific ARARs for this alternative are presented in Table E-1 in Appendix E; this alternative will be designed and implemented to comply with applicable location-specific ARARs.
Action Specific	Action specific ARARs for this alternative are presented in Table E-1 in Appendix E; this alternative will be designed and implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	With the construction of a final cover system over the landfill lobes and the excavation of impacted sediment from the brook, the residual risks for direct exposure of landfill waste and impacted sediment are eliminated. However, given the potential for some wastes to have been placed near or at the water table surface, the potential will remain for some leaching of contaminants from the waste into groundwater. Prevention of further impacts to the brook through groundwater containment and focused groundwater remediation will minimize future residual risk to re-contaminating the brook sediment and/or surface water. In conjunction with institutional controls, future risk of groundwater ingestion by site users will be controlled. Therefore, residual risk is low for this alternative.

TABLE LF-2b
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-2b: Containment of waste, vent landfill gas, restoration of wetlands and brook, containment of groundwater with a vertical barrier and groundwater remediation

EVALUATION CRITERIA	DETAILED ANALYSIS
Adequacy and Reliability of Controls	Capping of the landfill waste is an effective and reliable technology to prevent exposure to the waste and to reduce infiltration through the waste and leaching to groundwater. The combination of groundwater containment (via a vertical barrier), focused groundwater remediation and institutional controls will effectively and reliably limit human exposure to impacted groundwater until groundwater RAOs are met. Monitoring of the containment system and focused groundwater remediation will be required to demonstrate reliability.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	This alternative does not treat the landfill waste. Treatment of the excavated sediment is not anticipated prior to on-site disposal beneath the landfill final cover system; however, if deemed necessary based on the pre-design waste characterization results of the material being excavated, ex-situ treatment of soil may be implemented prior to on-site disposal. Materials addressed in groundwater through focused groundwater remediation (in situ or ex situ) will include VOCs, SVOCs & metals; If extraction and ex-situ treatment of groundwater are implemented, a combination of technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps (to be determined during the design phase) will be utilized to treat the extracted groundwater.
Amount Destroyed or Treated	The landfill waste and excavated sediment are not anticipated to be treated. Groundwater will be remediated with in situ treatment enhancements/technologies and/or groundwater ex-situ treatment. Current dissolved concentrations indicate an estimated 2,700 to 4,500 lbs of VOCs in Northern and Southern lobe groundwater.
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	Compared to the other alternatives evaluated for the landfill lobes, this alternative provides a moderate level of reduction in toxicity, mobility and volume of contaminants through groundwater treatment.
Degree to which Treatment is Irreversible	The groundwater treatment/remediation will be permanent.
Type and Quantity of Residuals Remaining after Treatment	This alternative does not treat the landfill waste. Through excavation of the impacted sediment, no residuals presenting exposure risks will remain. In situ and/or ex-situ groundwater treatment and any resulting VOC vapors or end-products may produce a low volume of treatment residuals that will require off-site treatment/disposal at a licensed facility.
Degree to Which Treatment Reduces Principal Threats	Principal threats of direct exposure and potential leaching from waste to groundwater are addressed via landfill containment (cap). The principal threats/ exposure risks of groundwater migration and ingestion will be controlled through groundwater containment (via vertical barrier), groundwater treatment (in situ or ex situ), natural attenuation, and institutional controls.

TABLE LF-2b
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-2b: Containment of waste, vent landfill gas, restoration of wetlands and brook, containment of groundwater with a vertical barrier and groundwater remediation

EVALUATION CRITERIA	DETAILED ANALYSIS
	SHORT-TERM EFFECTIVENESS
Protection of Community During Remedial Action	This alternative will have moderate short-term effects on the local community during the construction of the landfill final cover system due to an increase in local truck/ vehicular traffic (bringing in soil cover material). Limited short term effects are anticipated as a result of the sediment excavation or groundwater containment/remediation portions of this alternative.
Protection of Workers During Remedial Action	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.
Environmental Impacts	Impacts to the wetland resource areas are anticipated to be low to moderate during construction activities due to the location of the wetland resource areas surrounding the landfill lobes (erosion controls and stormwater management will be required to reduce impacts) and during the brook excavation, temporary re-directing/routing of the brook may be required to effectively remove the impacted sediment, potentially causing disruption to the existing ecological habitat. Once the landfill capping and brook excavation are complete, the groundwater containment/remediation components installed, and the area restored, operation and monitoring activities are anticipated to have minimal impacts. Available practical means such as erosion and stormwater control measures will also be implemented to minimize harm to wetland areas during construction.
Time Until Remedial Action Objectives are Achieved	Landfill waste RAOs will be achieved upon construction of the final cover system (design/approvals 1 year, construction 2 to 3 years) and the sediment RAOs will be achieved upon removal of the impacted sediment (confirmatory sediment sampling will be performed to document the achievement of RAOs) - (design/approvals - 1 year, construction/restoration 1 to 1.5 years). The estimated time to achieve groundwater RAOs is approximately 65 to 210 years
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	Construction of the landfill final cover system is a common technique that is straight forward to implement; the presence of wetland resource areas and the adjacent 100-year flood plain may present potential design challenges (stormwater management, etc.). Preliminary evaluation of stormwater/ drainage features at the site indicate that upon capping the landfill, use of the FDDA and Deep Marsh may be required for stormwater detention ponds. Excavation of impacted sediment from existing waterways is a fairly common construction activity; site specific engineering and erosion controls will be required to minimize environmental impacts. The installation of a vertical containment barrier and implementation of the focused groundwater remediation program involves common construction techniques. This alternative requires a lower level of operation, maintenance, and monitoring than other alternatives evaluated (e.g. LF-3).
Reliability of the Technology	Excavation of impacted sediment is an effective and reliable method since the material will be removed. Capping of the landfill waste is an effective and reliable technology to prevent direct exposure to the waste and to reduce infiltration through the waste into groundwater. The combination of groundwater containment (via a vertical barrier), focused groundwater remediation and institutional controls should effectively and reliably limit human exposure to impacted groundwater until groundwater RAOs are met.

TABLE LF-2b
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-2b: Containment of waste, vent landfill gas, restoration of wetlands and brook, containment of groundwater with a vertical barrier and groundwater remediation

EVALUATION CRITERIA	DETAILED ANALYSIS
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative should not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Confirmatory sediment sampling and analysis is easily implementable to measure the effectiveness of the brook sediment excavation. Groundwater monitoring to demonstrate contaminant containment and mass reduction is easily implementable.
Ability to Obtain Approvals and Coordinate with Other Agencies	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Facilities are available to treat or dispose of the excavated sediment within Massachusetts. However, there is also availability to re-use this material on-site at one of the landfill lobes beneath the final cover system. If groundwater extraction and ex-situ treatment are implemented, the treated groundwater can be discharged to surface water or to the local POTW.
Availability of Necessary Equipment and Specialists	Equipment, materials and services for this alternative are readily available.
Availability of Technology	Qualified engineers and contractors are available to design and implement this alternative.
	COSTS - *net present value (7%) - 30 years*
	LF-2b
Capital Costs	$19,700,000
Annual Operation, Maintenance and Monitoring	$5,400,000
Periodic Costs	$120,000
TOTAL	$25,220,000

TABLE LF-3
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-3: Containment of waste, vent landfill gas, restoration of wetlands and brook and contaminated groundwater collection and treatment

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The HHRA presumed that the Northern and Southern landfill lobes will be capped; thereby eliminating direct exposure to soils located in these areas. The results of the HHRA concluded if groundwater is used as a source of potable water, groundwater may also pose a risk to hypothetical future site residents or workers. Under this alternative, the landfill waste will be capped and impacted groundwater will be hydraulically controlled and treated (preventing migration and potential re-contamination of the brook), therefore the potential human health risks will be eliminated and RAOs will be achieved.
Ecological Protection	The results of the ecological risk assessment indicated that VOCs and/or metals in sediment and surface water within Sutton Brook between the two landfill lobes may pose potential risk to ecological receptors. Due to these potential future risks, PRGs were established for the specific constituents determined to the "risk drivers" in sediment and surface water. Under this alternative, the landfill waste will be capped, the southern lobe impacted groundwater will be hydraulically contained (preventing potential re-contamination of the brook sediment/surface water) and excavation of the impacted sediment will be conducted to reduce concentrations to meet RAOs.
COMPLIANCE WITH ARARs	
Chemical Specific	Potential chemical specific ARARs for this alternative are presented in Table E-1 in Appendix E; this alternative will be designed and implemented to comply with applicable chemical-specific ARARs.
Location Specific	Potential location specific ARARs for this alternative are presented in Table E-1 in Appendix E; this alternative will be designed and implemented to comply with applicable location-specific ARARs.
Action Specific	Action specific ARARs for this alternative are presented in Table E-1 in Appendix E; this alternative will be designed and implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	With the construction of a final cover system over the landfill lobes and the excavation of impacted sediment from the brook, the residual risks for direct exposure of landfill waste and impacted sediment are eliminated. However, given the potential for some wastes to have been placed near or at the water table surface, the potential will remain for some leaching of contaminants from the waste into groundwater. Prevention of further impacts to the brook through groundwater extraction and ex-situ treatment will minimize future residual risk to re-contaminating the brook sediment and/or surface water. In conjunction with institutional controls, future risk of groundwater ingestion by site users will be controlled. Therefore, residual risk is low for this alternative.
Adequacy and Reliability of Controls	Capping of the landfill waste is an effective and reliable technology to prevent direct exposure to the waste and to reduce infiltration through the waste and leaching to groundwater. The combination of groundwater hydraulic containment through groundwater extraction and ex-situ treatment and institutional controls will effectively and reliably limit human exposure to impacted groundwater until groundwater RAOs are met.

TABLE LF-3
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-3: Containment of waste, vent landfill gas, restoration of wetlands and brook and contaminated groundwater collection and treatment

EVALUATION CRITERIA	DETAILED ANALYSIS
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	This alternative does not treat the landfill waste. Treatment of the excavated sediment is not anticipated prior to on-site disposal beneath the landfill final cover system; however, if deemed necessary based on the pre-design waste characterization results of the material being excavated, ex-situ treatment of soil may be implemented prior to on-site disposal. Materials treated in groundwater through ex-situ groundwater treatment will include VOCs, SVOCs & metals; a combination of technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps (to be determined during the design phase) may be utilized to treat the extracted groundwater.
Amount Destroyed or Treated	The landfill waste and excavated sediment are not anticipated to be treated. Groundwater will be treated/destroyed with ex-situ treatment processes. Current dissolved concentrations indicate an estimated 2,700 to 4,500 lbs of VOCs in Northern and Southern lobe groundwater available for treatment.
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	Compared to other alternatives evaluated for the landfill lobes, this alternative provides a moderate level of reduction in toxicity, and volume and a high level of reduction in mobility of dissolved contaminants through groundwater extraction and treatment.
Degree to which Treatment is Irreversible	The groundwater treatment will be permanent.
Type and Quantity of Residuals Remaining after Treatment	This alternative does not treat the landfill waste. Through excavation of the impacted sediment, no residuals presenting exposure risks will remain. Treatment of the groundwater plume and any resulting VOC vapors will produce a moderate to high volume of treatment residuals that will require off-site treatment/disposal at a licensed facility.
Degree to Which Treatment Reduces Principal Threats	Principal threats of direct exposure and potential leaching from waste to groundwater are not addressed via treatment for this alternative (containment and excavation); however, through groundwater extraction and ex-situ treatment, and institutional controls, the principal threats/ exposure risks of groundwater migration and ingestion will be reduced.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	This alternative will have moderate short-term effects on the local community during the construction of the landfill final cover system due to an increase in local truck/ vehicular traffic (bringing in soil cover material). Limited short term effects are anticipated as a result of the sediment excavation or groundwater treatment system installation portions of this alternative.
Protection of Workers During Remedial Action	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.
Environmental Impacts	Impacts to the wetland resource areas are anticipated to be moderate during construction activities due to the location of the wetland resource areas surrounding the landfill lobes (erosion controls and stormwater management will be required to reduce impacts) and during the brook excavation, temporary re-directing/routing of the brook may be required to effectively remove the impacted sediment, potentially causing disruption to the existing ecological habitat. Once the landfill capping and brook excavation are complete, the groundwater hydraulic containment/ ex-situ treatment system installed, and the area restored, operation and monitoring activities are anticipated to have minimal environmental impacts. Available practical means such as erosion and stormwater control measures will also be implemented to minimize harm to wetland areas during construction.

TABLE LF-3
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-3: Containment of waste, vent landfill gas, restoration of wetlands and brook and contaminated groundwater collection and treatment

EVALUATION CRITERIA	DETAILED ANALYSIS
Time Until Remedial Action Objectives are Achieved	Landfill waste RAOs will be achieved upon construction of the final cover system (design/approvals 1 year, construction 2 to 3 years) and the sediment RAOs will be achieved upon removal of the impacted sediment (confirmatory sediment sampling will be performed to document the achievement of RAOs) - (design/approvals - 1 year, construction/restoration 1 to 1.5 years) . The estimated time to achieve groundwater RAOs is approximately 52 to 164 years
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	Construction of a landfill final cover system is a common technique that is straight forward to implement; the presence of wetland resource areas and the adjacent 100-year flood plain may present potential design challenges (stormwater management, etc.). Preliminary evaluation of stormwater/ drainage features at the site indicate that upon capping the landfill, use of the FDDA and Deep Marsh will likely be required for stormwater detention ponds. Excavation of impacted sediment from existing waterways is a fairly common construction activity; site specific engineering and erosion controls will be required to minimize environmental impacts. The installation of a groundwater treatment system involves common construction techniques. This alternative requires a higher level of operation, maintenance and monitoring compared to other alternatives evaluated (e.g. LF-2 and LF-4).
Reliability of the Technology	Excavation of impacted sediment is an effective and reliable method since the material will be removed. Capping of the landfill waste is an effective and reliable technology to prevent direct exposure to the waste and to reduce infiltration through the waste into groundwater. The combination of groundwater treatment and institutional controls should limit human exposure to impacted groundwater until groundwater RAOs are met. This alternative, however, has a reduced level of reliability in containing the groundwater in comparison to alternative LF-2 due to the potential for mechanical failure of equipment over time, providing the potential for groundwater to migrate into the brook and/or downgradient.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative should not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Confirmatory sediment sampling and analysis is easily implementable to measure the effectiveness of the brook sediment excavation. Groundwater monitoring to demonstrate contaminant containment and reduction is easily implementable.
Ability to Obtain Approvals and Coordinate with Other Agencies	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Facilities are available to treat or dispose of the excavated sediment within Massachusetts. However, there is also availability to re-use this material on-site at one of the landfill lobes beneath the final cover system. Treated groundwater can be discharged to surface water or to the local POTW.
Availability of Necessary Equipment and Specialists	Equipment, materials and services for this alternative are readily available.
Availability of Technology	Qualified engineers and contractors are available to design and implement this alternative.
	COSTS - *net present value (7%) - 30 years*
Capital Costs	$24,900,000
Annual Operation, Maintenance and Monitoring	$15,900,000 to $26,100,000
Periodic Costs	$130,000
TOTAL	$40,930,000 to $51,130,000

LF-3 - O&M Range incorporates: 30 years of system operation with 30 years of groundwater monitoring - low: discharge to surface water, high: discharge to POTW

TABLE LF-4
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-4: Containment of waste, vent landfill gas, re-routing of the brook, excavation of impacted sediment hot spots, containment of groundwater (vertical

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The HHRA presumed that the Northern and Southern landfill lobes will be capped; thereby eliminating direct exposure to soils located in these areas. The results of the HHRA concluded if groundwater is used as a source of potable water, groundwater may also pose a risk to hypothetical future site residents or workers. Under this alternative, the landfill waste will be capped and impacted groundwater immediately adjacent to the Southern lobe will be remediated and prevented from discharging into the brook (preventing migration and potential re-contamination of the brook) and impacted groundwater from the Northern lobe will be addressed by in-situ natural attenuation, therefore the potential human health risks will be controlled and RAOs will be achieved.
Ecological Protection	The results of the ecological risk assessment indicated that VOCs and/or metals in sediment and surface water within Sutton Brook between the two landfill lobes may pose potential risk to ecological receptors. Due to these potential risks, PRGs were established for the specific constituents determined to be "risk drivers" in sediment and surface water. Under this alternative, the landfill waste will be capped, hot spot areas within the brook will be excavated, the brook will be re-routed around the Southern Lobe, and impacted groundwater from the Southern lobe will be controlled/treated, minimizing discharge to the newly re-routed brook. Through these remedial actions, RAOs will be achieved.
COMPLIANCE WITH ARARs	
Chemical Specific	Chemical specific ARARs for this alternative are presented in Table E-1 in Appendix E; this alternative will be designed and implemented to comply with applicable chemical specific ARARs.
Location Specific	Potential location specific ARARs for this alternative are presented in Table E-1 in Appendix E. Resource areas which will require alteration include Bordering Land Subject to Flooding, Inland Bank, Land Under Water, Riverfront Area, and Bordering Vegetated Wetlands. Due to the issues involved with re-routing the brook (with respect to altering and re-creating these resource areas and re-creating the 100-year flood plain), specifically the lack of space available to fully mitigate (both the function and value) of the loss of resource areas, in conjunction with a major disruption to the existing hydrogeological features and ecological habitats, this alternative **will most likely not** meet applicable location-specific ARARs.
Action Specific	Action specific ARARs for this alternative are presented in Table E-1 in Appendix E; this alternative will be designed and implemented to comply with applicable action-specific ARARs.

TABLE LF-4
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-4: Containment of waste, vent landfill gas, re-routing of the brook, excavation of impacted sediment hot spots, containment of groundwater (vertical

EVALUATION CRITERIA	DETAILED ANALYSIS
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	With the construction of a final cover system over the landfill lobes, the excavation of hot spot areas of impacted sediment from the former brook and the re-creation of the brook around the southern edge of the landfill, the residual risks for direct exposure of landfill waste and impacted sediment are reduced. Further impacts to the newly re-routed brook through groundwater containment (vertical barrier) and focused groundwater treatment will reduce future residual risk to contaminating the re-routed brook sediment and/or surface water and, in conjunction with institutional controls, will control future risk of groundwater ingestion by future site users. Therefore, residual risk is low for this alternative.
Adequacy and Reliability of Controls	Capping of the landfill waste is an effective and reliable technology to prevent exposure to the waste and to reduce infiltration through the waste leaching to groundwater. Re-routing of the brook around the Southern lobe, in conjunction with the vertical groundwater containment barrier, will effectively and reliably minimize future contamination of the brook sediment and/or surface water. The combination of groundwater containment (via a vertical barrier), focused groundwater treatment and institutional controls should effectively and reliably limit human exposure to impacted groundwater until groundwater RAOs are achieved. Monitoring of the containment system and focused groundwater treatment will be required to demonstrate reliability.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	This alternative does not treat the landfill waste. Treatment of the excavated sediment is not anticipated prior to on-site disposal beneath the landfill final cover system; however, if deemed necessary based on the pre-design waste characterization results of the material being excavated, ex-situ treatment of soil may be implemented prior to on-site disposal. Materials treated in groundwater through focused groundwater treatment will include VOCs, SVOCs & metals; in situ measures could actively treat these COCs and if extraction and ex-situ treatment of groundwater are implemented, a combination of technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps (to be determined during the design phase) will be utilized to treat the extracted groundwater.
Amount Destroyed or Treated	The landfill waste and excavated sediment are not anticipated to be treated. Groundwater will be treated/destroyed by in situ measures and/or groundwater ex situ treatment. Current dissolved concentrations indicate an estimated 2,700 to 4,500 lbs of VOCs in Northern and Southern lobe groundwater.

TABLE LF-4
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-4: Containment of waste, vent landfill gas, re-routing of the brook, excavation of impacted sediment hot spots, containment of groundwater (vertical

EVALUATION CRITERIA	DETAILED ANALYSIS
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	Compared to the other alternatives evaluated for the landfill lobes, this alternative provides a moderate level of reduction in toxicity, mobility and volume of contaminants through groundwater treatment.
Degree to which Treatment is Irreversible	The groundwater treatment will be permanent.
Type and Quantity of Residuals Remaining after Treatment	This alternative does not treat the landfill waste. Through excavation of the impacted sediment, no residuals presenting exposure risks will remain. If groundwater extraction and ex-situ treatment is implemented, treatment of groundwater and any resulting VOC vapors will produce a low volume of treatment residuals that will require off-site treatment/disposal at a licensed facility.
Degree to Which Treatment Reduces Principal Threats	Principal threats of direct exposure and potential leaching from waste to groundwater are addressed via landfill containment (cap). The principal threats/ exposure risks of groundwater migration and ingestion will be controlled through groundwater containment (via vertical barrier), groundwater treatment, natural attenuation, and institutional controls.
	SHORT-TERM EFFECTIVENESS
Protection of Community During Remedial Action	This alternative will have moderate to high short-term effects on the local community during the construction of the landfill final cover system and the re-routing of the brook due to an increase in local truck/ vehicular traffic (bringing in soil cover material, lengthier construction timeframe). Limited short term effects are anticipated as a result of the groundwater containment/treatment portions of this alternative.
Protection of Workers During Remedial Action	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.
Environmental Impacts	Impacts to the wetland resource areas are anticipated to be high during construction activities due to the destruction of the existing wetland/marsh area to the south of the Southern lobe during the brook re-creation (disrupting ecological habitat) and due to the location of the wetland resource areas surrounding the landfill lobes (erosion controls and stormwater management will be required to reduce impacts). Once the landfill capping, brook re-creation, former brook excavation and filling are complete, the groundwater containment/treatment components installed, and the area restored, groundwater operation and monitoring activities are anticipated to have limited impacts.

TABLE LF-4
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-4: Containment of waste, vent landfill gas, re-routing of the brook, excavation of impacted sediment hot spots, containment of groundwater (vertical

EVALUATION CRITERIA	DETAILED ANALYSIS
Time Until Remedial Action Objectives are Achieved	Landfill waste RAOs will be achieved upon construction of the final cover system (design/ approval 1 year, construction 2 to 3 years) and the sediment RAOs will be achieved upon re-routing of the brook, removal of the impacted sediment and restoration of the former brook area - (design/ approvals 2 years, construction/restoration 1 to 2 years) . The estimated time to achieve groundwater RAOs is approximately 65 to 210 years
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	Construction of a landfill final cover system is a common technique that is straight forward to implement; the presence of wetland resource areas and the adjacent 100-year flood plain may present potential design challenges for the cover system (stormwater management, etc.). Preliminary evaluation of stormwater/ drainage features at the site indicate that upon capping the landfill, use of the FDDA and Deep Marsh may be required for stormwater detention ponds. Excavation of impacted sediment from existing waterways is a fairly common construction activity; site specific engineering and erosion controls will be required to minimize environmental impacts. Resource areas which will require alteration with re-routing the brook include Bordering Land Subject to Flooding, Inland Bank, Land Under Water, Riverfront Area, and Bordering Vegetated Wetlands. Therefore, all work performed in these areas will present numerous challenges with access and disruption. The installation of a vertical containment barrier and implementation of the focused groundwater treatment involves common construction techniques.
Reliability of the Technology	In conjunction with groundwater containment and treatment, re-routing of the brook and excavation of hot-spot impacted sediment are effective and reliable to eliminate current and potential future risks. Capping of the landfill waste is an effective and reliable technology to prevent direct exposure to the waste and to reduce infiltration through the waste into groundwater. The combination of groundwater containment (via a vertical barrier), focused groundwater treatment and institutional controls should effectively and reliably limit human exposure to impacted groundwater until groundwater RAOs are met.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative should not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Confirmatory sediment sampling and analysis is easily implementable to measure the effectiveness of the brook sediment excavation. Groundwater monitoring to demonstrate contaminant containment and mass reduction is easily implementable.

TABLE LF-4
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table LF-4: Containment of waste, vent landfill gas, re-routing of the brook, excavation of impacted sediment hot spots, containment of groundwater (vertical

EVALUATION CRITERIA	DETAILED ANALYSIS
Ability to Obtain Approvals and Coordinate with Other Agencies	With the potential ARAR issues in regards to the Wetlands Protection Act, this alternative may have difficulty obtaining substantial compliance with federal and state agencies.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Facilities are available to treat or dispose of the excavated sediment within Massachusetts. However, there is also availability to re-use this material on-site at one of the landfill lobes beneath the final cover system. If groundwater extraction and ex-situ treatment are implemented, the treated groundwater can be discharged to surface water or to the local POTW.
Availability of Necessary Equipment and Specialists	Equipment, materials and services for this alternative are available.
Availability of Technology	Qualified engineers and contractors are available to design and implement this alternative.
COSTS - *net present value (7%) - 30 years*	
Capital Costs	$25,900,000
Annual Operation, Maintenance and Monitoring	$5,400,000
Periodic Costs	$120,000
TOTAL	$31,420,000

TABLE FDDA-1
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-1: No Action

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The results of the human health risk assessment indicated that VOCs and SVOCs in soil may pose a potential risk to receptors. The potential for volatilization of select VOCs in groundwater may pose a potential risk to future site residents or facility workers. If groundwater is used as a source of potable water, groundwater in the FDDA may also pose a potential risk to future site residents or facility workers. Under this alternative, no remedial actions will be conducted to reduce concentrations in soil or groundwater to RAOs, therefore the potential future risk to trespassers, site residents, facility workers and/or construction workers will remain and RAOs will not be achieved.
Ecological Protection	The results of the ecological risk assessment indicated that select SVOCs and VOCs in soil within the FDDA may pose potential risk to ecological receptors. Under this alternative, no remedial actions will be conducted to reduce concentrations to meet cleanup goals therefore the potential future risk to ecological receptors will remain and RAOs will not be achieved.
COMPLIANCE WITH ARARs	
Chemical Specific	Under existing conditions, concentrations of select compounds in soil and groundwater exceed chemical specific ARARs. Contaminant concentrations in soil and groundwater are not anticipated to reduce significantly in the foreseeable future; therefore, chemical specific ARARs will not be met for this alternative.
Location Specific	Location specific ARARs do not apply for this alternative since there are no remedial activities associated with this alternative that will cause adverse impacts to natural resources.
Action Specific	Action specific ARARs do not apply for this alternative since there are no remedial activities associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Since there are no active remedial actions or institutional controls associated with this alternative, potential future exposure to site residents, facility workers, construction workers and ecological receptors to contaminants in soil and groundwater will continue to pose a potential residual risk.
Adequacy and Reliability of Controls	No controls are proposed for this alternative.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No active treatment is proposed for this alternative.
Amount Destroyed or Treated	None
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	No active treatment is proposed for this alternative, therefore, no reduction in toxicity, mobility or volume through treatment will be achieved with this alternative.

TABLE FDDA-1
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-1: No Action

EVALUATION CRITERIA	DETAILED ANALYSIS
Degree to which Treatment is Irreversible	No treatment is proposed.
Type and Quantity of Residuals Remaining after Treatment	Existing conditions will remain since no treatment is proposed.
Degree to Which Treatment Reduces Principal Threats	No treatment is proposed.
	SHORT-TERM EFFECTIVENESS
Protection of Community During Remedial Action	Not applicable since no remedial actions are included in this alternative.
Protection of Workers During Remedial Action	Not applicable since no remedial actions are included in this alternative.
Environmental Impacts	Not applicable since no remedial actions are included in this alternative.
Time Until Remedial Action Objectives are Achieved	No remedial actions will be implemented to reduce concentrations in soil or groundwater to cleanup goals Therefore, RAO's will not be achieved through implementation of this alternative.
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	Not applicable since no remedial actions are included in this alternative.
Reliability of the Technology	Not applicable since no remedial actions are included in this alternative.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Not applicable since no remedial actions or monitoring are included in this alternative.
Ability to Obtain Approvals and Coordinate with Other Agencies	Not applicable since no remedial actions are included in this alternative; therefore, no approvals or coordination required.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Not applicable for this alternative.
Availability of Necessary Equipment and Specialists	No equipment or specialists required for this alternative.
Availability of Technology	Not applicable since no remedial technologies will be used.
	COSTS - *net present value (7%)*
Capital Costs	$0
Annual Operation, Maintenance and Monitoring	$41,000
Periodic Costs	$43,000
TOTAL	$84,000

TABLE FDDA-2
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-2: Containment of soil (with cap) and hydraulic containment of groundwater (through extraction and ex-situ treatment)

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The results of the human health risk assessment indicated that VOCs and SVOCs in soil may pose a potential risk to receptors. The potential for volatilization of select VOCs in groundwater may pose a potential risk to future site residents or facility workers. If groundwater is used as a source of potable water, groundwater in the FDDA may also pose a potential risk to future site residents or facility workers. Under this alternative, an engineered barrier will be constructed to eliminate human exposure via direct contact and volatilization from soil and groundwater. A groundwater extraction and ex-situ treatment system to hydraulically contain impacted groundwater and reduce the mass of contaminants in groundwater will also be implemented. Hydraulic containment of groundwater will prevent downgradient migration and exposure. Institutional controls will also be implemented to control ingestion and direct exposure to soil and groundwater. I
Ecological Protection	The results of the ecological risk assessment indicated that select SVOCs and VOCs in soil within the FDDA may pose potential risk to ecological receptors. Under this alternative, containment of the impacted soil through an engineered barrier will be constructed to control ecological exposure.
COMPLIANCE WITH ARARs	
Chemical Specific	Under existing conditions, concentrations of select compounds in soil and groundwater exceed chemical specific ARARs. This alternative will prevent exposure to the impacted material, but will not meet the PRGs established and therefore not comply with the chemical specific ARARs.
Location Specific	Potential location specific ARARs for this alternative are presented in Table E-2 in Appendix E; this alternative will be designed and implemented to comply with applicable location-specific ARARs.
Action Specific	Action specific ARARs for this alternative are presented in Table E-2 in Appendix E; this alternative will be designed and implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	The impacted soil will remain beneath the containment barrier, which will reduce the potential for future leaching into groundwater over time. Hydraulic containment of impacted groundwater will reduce residual risk, preventing downgradient exposure while actively reducing the mass of dissolved contaminants in groundwater. However, since impacted soil will remain in the FDDA, residual risk is moderate to high compared to other alternatives.
Adequacy and Reliability of Controls	Assuming effective implementation, institutional controls should effectively limit human exposure to impacted soil and groundwater until RAOs are achieved. Monitoring of the extraction system's effectiveness in hydraulically containing the plume will be required to determine the reliability of the groundwater component of this alternative and routine inspection that the containment barrier is intact will be required to determine the reliability of the soil component of this alternative.

TABLE FDDA-2
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-2: Containment of soil (with cap) and hydraulic containment of groundwater (through extraction and ex-situ treatment)

EVALUATION CRITERIA	DETAILED ANALYSIS
	REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT
Treatment Process Used and Materials Treated	This alternative does not treat the impacted soil. Materials treated within groundwater through the hydraulic containment extraction and ex-situ treatment system will include VOCs, SVOCs & metals via a combination of technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps (to be determined during remedial design phase).
Amount Destroyed or Treated	No soil will be treated, but an estimated total extraction rate of 20 gpm of groundwater will be treated through the hydraulic containment groundwater extraction and ex-situ treatment system. Current dissolved concentrations indicate an estimated 1,600 to 2,000 lbs of VOCs in FDDA groundwater available for treatment. With the soil remaining in-situ, the potential exists for future leaching of additional contaminants from soil to groundwater.
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	Compared to other alternatives evaluated for the FDDA, this alternative provides a minimal level of reduction in toxicity, and volume and a moderate level of reduction in mobility of contaminants through treatment.
Degree to which Treatment is Irreversible	No soil will be actively treated. The groundwater treatment will be permanent.
Type and Quantity of Residuals Remaining after Treatment	Treatment of the groundwater plume and any resulting VOC vapors will result in a minimal volume of treatment residuals that will require off-site treatment/disposal at a licensed facility.
Degree to Which Treatment Reduces Principal Threats	Principal threats of soil exposure and potential leaching from soil to groundwater are not addressed via treatment for this alternative; however, in conjunction with institutional controls, the extraction and treatment of contaminants in groundwater will reduce the principal threats/ exposure risks.
	SHORT-TERM EFFECTIVENESS
Protection of Community During Remedial Action	Construction of the soil containment barrier and construction and operation of the on-site groundwater treatment facility will not have significant short-term impacts on the local community.
Protection of Workers During Remedial Action	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.
Environmental Impacts	Impacts to the wetland resource areas are anticipated to be moderate (compared to other alternatives) during construction activities due to the location of the extraction wells and the containment barrier within and/or adjacent to the resource area. Once the containment barrier and the groundwater treatment system are installed, operation and monitoring activities are anticipated to have limited impacts. Available practical means such as erosion and stormwater control measures will also be implemented to minimize harm to wetland areas during construction.
Time Until Remedial Action Objectives are Achieved	The estimated time to achieve RAOs with this alternative is approximately 30 to 134 years

TABLE FDDA-2
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-2: Containment of soil (with cap) and hydraulic containment of groundwater (through extraction and ex-situ treatment)

EVALUATION CRITERIA	DETAILED ANALYSIS
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	The installation of wells and piping for the hydraulic containment groundwater treatment system involves common construction techniques; however due to the location of the impacted groundwater within and adjacent to the wetland resource area, this alternative poses difficulty in implementation to reduce environmental impacts and in designing the treatment system layout. Prior to implementation, pre-design pilot studies will be required to determine groundwater capture zones. Construction of a soil containment barrier involves common construction techniques. Stormwater/ drainage features will be required as part of the design.
Reliability of the Technology	Hydraulic containment through groundwater extraction is a demonstrated and reliable method for capturing and collecting impacted groundwater. In addition, available ex-situ treatment components are effective in treating groundwater to meet discharge limits. Institutional controls and containment barriers are common and reliable technologies to reduce/eliminate exposure to impacted soil and groundwater.
Ease of Undertaking Additional Remedial Actions, if necessary	Utilizing the area as a stormwater management basin for the Northern lobe final cover system and leaving the soil in place will present significant difficulty in undertaking additional remedial actions due to access restrictions.
Ability to Monitor Effectiveness of Remedy	Groundwater monitoring to demonstrate contaminant reduction is easily implementable. Treatment system effluent will be monitored on a routine basis to evaluate the effectiveness of the treatment system and document that discharge requirements are being met. Routine inspection of the soil containment barrier is easily implementable as well.
Ability to Obtain Approvals and Coordinate with Other Agencies	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	No off-site treatment, storage or disposal services required for the soil component of the alternative. Discharge of the treated groundwater will be to surface water or the local POTW.
Availability of Necessary Equipment and Specialists	Equipment, materials and services for this alternative are readily available.
Availability of Technology	Qualified engineers and contractors are available to design and implement this alternative.
	COSTS - *net present value (7%)*
Capital Costs	$3,100,000
Annual Operation, Maintenance and Monitoring	$4,300,000 to $5,100,000
Periodic Costs	$130,000
TOTAL	$7,530,000 to $8,330,000

O&M cost range based on discharge method - low end to surface water, high end to POTW

TABLE FDDA-3
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-3: Excavation, treatment and/or disposal of soil with hydraulic containment of groundwater (through extraction and ex-situ treatment)

EVALUATION CRITERIA	DETAILED ANALYSIS
	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
Human Health Protection	The results of the human health risk assessment indicated that VOCs and SVOCs in soil may pose a potential risk to receptors. The potential for volatilization of select VOCs in groundwater may pose a potential risk to future site residents or facility workers. If groundwater is used as a source of potable water, groundwater in the FDDA may also pose a risk to future site residents or facility workers. Under this alternative, excavation of the impacted soil will be conducted to reduce concentrations to meet RAOs, therefore eliminating the potential human health risks associated with the impacted soil and achieving site RAOs for soil. In addition, a groundwater extraction and existing treatment system to hydraulically contain impacted groundwater and reduce the mass of contaminants in groudnwater will also be implemented. Hydraulic containment of groundwater will prevent downgradient migration and exposure. Institutional controls will also be implemented to reduce/prevent exposure to groundwater.
Ecological Protection	The results of the ecological risk assessment indicated that select SVOCs and VOCs in soil within the FDDA may pose potential risk to ecological receptors. Under this alternative, excavation of the impacted soil will be conducted to meet cleanup goals. Therefore the potential future risk to ecological receptors will be eliminated and RAOs for soil will be achieved.
	COMPLIANCE WITH ARARs
Chemical Specific	Potential chemical specific ARARs for this alternative are presented in Table E-2 in Appendix E; this alternative will be designed and implemented to comply with applicable chemical-specific ARARs.
Location Specific	Potential location specific ARARs for this alternative are presented in Table E-2 in Appendix E; this alternative will be designed and implemented to comply with applicable location-specific ARARs.
Action Specific	Action specific ARARs for this alternative are presented in Table E-2 in Appendix E; this alternative will be designed and implemented to comply with applicable action-specific ARARs.
	LONG-TERM EFFECTIVENESS AND PERMANENCE
Magnitude of Residual Risk	The removal of impacted soil will significantly reduce residual risks due to this media. Hydraulic containment of impacted groundwater will significantly reduce residual risk, preventing downgradient exposure, while reducing the mass of contaminants in groundwater. Therefore, residual risk is low compared to other alternatives (e.g., FDDA-2).
Adequacy and Reliability of Controls	Excavation of impacted soil will provide long-term effectiveness and permanence since the material will be removed. Post excavation confirmatory soil samples will be collected to document the reliability of the removal. Assuming effective implementation, institutional controls should effectively limit human exposure to impacted groundwater until groundwater RAOs are achieved. Monitoring of the extraction system's effectiveness in hydraulically containing the plume will be required to measure the reliability of the groundwater component of this alternative.

TABLE FDDA-3
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-3: Excavation, treatment and/or disposal of soil with hydraulic containment of groundwater (through extraction and ex-situ treatment)

EVALUATION CRITERIA	DETAILED ANALYSIS
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	Treatment of the excavated soil may or may not be required prior to disposal; depending on the waste characterization results of the material being excavated, ex-situ treatment of soil may be implemented prior to disposal. Materials treated within groundwater through the hydraulic containment extraction and ex-situ treatment system will include VOCs, SVOCs & metals via a combination of technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps (to be determined during remedial design phase).
Amount Destroyed or Treated	Treatment of a portion of the excavated soil may be required prior to disposal; however, the volume or concentrations will be dependent on waste characterization analysis. An estimated total extraction rate of 24 gpm of groundwater will be treated through the hydraulic containment groundwater extraction and ex-situ treatment system. Current dissolved concentrations indicate an estimated 1,600 to 2,000 lbs of VOCs in FDDA groundwater available for treatment.
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	Treatment of a portion of the excavated soil may be required prior to disposal; however, the volume or concentrations will be dependent on waste characterization analysis. Compared to other alternatives evaluated for the FDDA, this alternative provides a moderate level of reduction in toxicity, mobility and volume of contaminants through groundwater treatment.
Degree to which Treatment is Irreversible	The groundwater and if required, soil treatment will be permanent.
Type and Quantity of Residuals Remaining after Treatment	Through excavation of the impacted soil, no residuals presenting exposure risks will remain. Treatment of the groundwater plume and any resulting VOC vapors will result in a low to moderate volume of treatment residuals that will require off-site treatment/disposal at a licensed facility.
Degree to Which Treatment Reduces Principal Threats	Principal threats of soil exposure and potential leaching from soil to groundwater are not addressed via treatment for this alternative; however, through source excavation, institutional controls, and hydraulic containment of groundwater (through groundwater extraction and treatment), the principal threats/ exposure risks will be controlled.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	This alternative will not have significant short-term effects on the local community. Re-use/disposal of the material on-site is anticipated beneath the landfill final cover system; however, should off-site treatment be required, local truck/ vehicular traffic will increase during implementation.
Protection of Workers During Remedial Action	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.
Environmental Impacts	Impacts to the wetland resource areas are anticipated to be moderate during construction activities due to the location of the extraction wells and the excavation extent within and/or adjacent to the wetland resource area. Once the excavation is complete, the groundwater treatment system is installed, and the area restored, operation and monitoring activities are anticipated to have limited to no impacts. Available practical means such as erosion and stormwater control measures will also be implemented to minimize harm to wetland areas during construction.

TABLE FDDA-3
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-3: Excavation, treatment and/or disposal of soil with hydraulic containment of groundwater (through extraction and ex-situ treatment)

EVALUATION CRITERIA	DETAILED ANALYSIS
Time Until Remedial Action Objectives are Achieved	Soil RAOs will be achieved upon removal of the impacted soil; confirmatory soil sampling will be performed to document the achievement of soil RAOs. The estimated time to achieve groundwater RAOs is approximately 24 to 89 years
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	Soil excavation involves common techniques that are straight forward to implement. Erosion controls will be required as part of the design and implementation to reduce environmental impacts to the adjacent wetlands. The installation of wells and piping for the hydraulic containment groundwater treatment system involves common construction techniques; however due to the location of the impacted groundwater within and adjacent to the wetland resource area, this alternative poses difficulty in implementation to reduce environmental impacts and in designing the treatment system layout. Prior to implementation, pre-design pilot studies will be required to determine groundwater capture zones.
Reliability of the Technology	Excavation of impacted soil is a reliable technology to quickly and effectively eliminate exposure risks and remove mass. Implementation of institutional controls is a common and reliable component of the remedy to control exposure to impacted groundwater. Hydraulic containment through groundwater extraction is a demonstrated and reliable method for capturing and collecting impacted groundwater. In addition, available ex-situ treatment components are effective in treating groundwater to meet discharge limits.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Confirmatory soil sampling and analysis is easily implementable to measure the effectiveness of the soil component of this alternative. Groundwater monitoring to demonstrate contaminant reduction is easily implementable. Treatment system effluent will be monitored on a routine basis to evaluate the effectiveness of the treatment system and document that discharge requirements are being met.
Ability to Obtain Approvals and Coordinate with Other Agencies	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Facilities are available to treat or dispose of the excavated material within the northeast. However, it is assumed that excavated soil will be reused/disposed of on-site at one of the landfill lobes beneath the final cover system. Discharge of the treated groundwater will be to surface water or the local POTW.

TABLE FDDA-3
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-3: Excavation, treatment and/or disposal of soil with hydraulic containment of groundwater (through extraction and ex-situ treatment)

EVALUATION CRITERIA	DETAILED ANALYSIS
Availability of Necessary Equipment and Specialists	Equipment, materials and services for this alternative are readily available.
Availability of Technology	Qualified engineers and contractors are available to design and implement this alternative.
	COSTS - *net present value (7%)*
Capital Costs	$3,400,000
Annual Operation, Maintenance and Monitoring	$4,100,000 to $5,700,000
Periodic Costs	$120,000
TOTAL	$7,620,000 to $9,220,000

O&M cost range based on discharge method - low end to surface water, high end to POTW

TABLE FDDA-4
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-4: Excavation, treatment and/or disposal of soil with groundwater treatment (focused mass reduction)

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The results of the human health risk assessment indicated that VOCs and SVOCs in soil may pose a potential risk to receptors. The potential for volatilization of select VOCs in groundwater may pose a potential risk to future site residents or facility workers. If groundwater is used as a source of potable water, groundwater in the FDDA may also pose a risk to future site residents or facility workers. Under this alternative, excavation of the impacted soil will be conducted to reduce concentrations to meet RAOs therefore eliminating the potential human health risks associated with the impacted soil and achieving site RAOs for soil. In situ natural attenuation mechanisms will be monitored to address groundwater impacts following a phased approach to the groundwater remedy.
Ecological Protection	The results of the ecological risk assessment indicated that select SVOCs and VOCs in soil within the FDDA may pose potential risk to ecological receptors. Under this alternative, excavation of the impacted soil will be conducted to meet cleanup goals therefore the potential future risk to ecological receptors will be eliminated and RAOs for soil will be achieved.
COMPLIANCE WITH ARARs	
Chemical Specific	Potential chemical specific ARARs for this alternative are presented in Table E-2 in Appendix E; this alternative will be designed and implemented to comply with applicable chemical-specific ARARs.
Location Specific	Potential location specific ARARs for this alternative are presented in Table E-2 in Appendix E; this alternative will be designed and implemented to comply with applicable location-specific ARARs.
Action Specific	Action specific ARARs for this alternative are presented in Table E-2 in Appendix E; this alternative will be designed and implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Removal of the impacted soil through excavation will significantly reduce residual risk associated with the impacted soil and minimize the potential for future leaching of contaminants from soil to groundwater. A phased groundwater remedial action will further reduce residual risk over time. Therefore, residual risk is low to moderate compared to other alternatives.
Adequacy and Reliability of Controls	Excavation of impacted soil will provide long-term effectiveness and permanence since the material will be removed. Post excavation confirmatory soil samples will be collected to document the reliability of the removal. Assuming effective implementation, institutional controls should effectively limit human exposure to impacted groundwater until groundwater RAOs are achieved. Monitoring of the MNA program's effectiveness will be required to measure the reliability of the groundwater component of this alternative.

TABLE FDDA-4
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-4: Excavation, treatment and/or disposal of soil with groundwater treatment (focused mass reduction)

EVALUATION CRITERIA	DETAILED ANALYSIS
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	Treatment of the excavated soil may or may not be required prior to on-site disposal; depending on the waste characterization results of the material being excavated, ex-situ treatment of soil may be implemented prior to disposal beneath the landfill final cover system. Natural attenuation processes, including biodegradation, dispersion, dilution, adsorption, volatilization and/or chemical and biological stabilization or destruction of contaminants, will address groundwater COPCs in situ. Following the phased approach, this alternative may also include an active groundwater treatment component.
Amount Destroyed or Treated	Treatment of a portion of the excavated soil may be required prior to disposal; however, the volume or concentrations will be dependent on waste characterization analysis. Current dissolved concentrations indicate an estimated 1,600 to 2,000 lbs of VOCs in FDDA groundwater. Natural attenuation processes will address the dissolved plume through biodegradation, dispersion, dilution, adsorption, volatilization and/or chemical and biological stabilization or destruction. Active groundwater treatment system will be implemented, if needed following the phased approach.
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	Treatment of a portion of the excavated soil may be required prior to disposal beneath the landfill final cover system; however, the volume or concentrations will be dependent on waste characterization analysis.
Degree to which Treatment is Irreversible	If required, groundwater and soil treatment will be permanent.
Type and Quantity of Residuals Remaining after Treatment	Through excavation of the impacted soil, no residuals presenting exposure risks will remain. With natural attenuation of groundwater, there will be no residuals requiring disposal.
Degree to Which Treatment Reduces Principal Threats	Principal threats of soil exposure and potential leaching from soil to groundwater are not addressed via treatment for this alternative; however, through source excavation, institutional controls, and natural attenuation mechanisms, the principal threats/ exposure risks will be controlled.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	This alternative will not have significant short-term effects on the local community. Re-use/disposal of soil on-site is anticipated beneath the landfill final cover system; however, should off-site treatment be required, local truck/ vehicular traffic will increase during implementation.
Protection of Workers During Remedial Action	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.
Environmental Impacts	Impacts to the wetland resource areas are anticipated to be low to moderate during construction activities due to the location of the excavation extent within and/or adjacent to the wetland resource area. Once the excavation is complete and the area restored, monitoring activities are anticipated to have limited to no impacts. Available practical means such as erosion and stormwater control measures will also be implemented to minimize harm to wetland areas during construction.

TABLE FDDA-4
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-4: Excavation, treatment and/or disposal of soil with groundwater treatment (focused mass reduction)

EVALUATION CRITERIA	DETAILED ANALYSIS
Time Until Remedial Action Objectives are Achieved	Soil RAOs will be achieved upon removal of the impacted soil; confirmatory soil sampling will be performed to document the achievement of RAOs. The estimated time to achieve groundwater RAOs is approximately 36 to 103 years
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	Soil excavation involves common techniques that are straight forward to implement. Erosion controls will be required as part of the design and implementation to reduce environmental impacts to the adjacent wetlands. If implemented, the installation of wells and piping for the focused groundwater extraction and ex-situ treatment system involves common construction techniques. Prior to implementation, pre-design pilot studies will be required to determine groundwater capture zones.
Reliability of the Technology	Excavation of impacted soil is a reliable technology to quickly and effectively eliminate exposure risks and remove mass. Implementation of institutional controls is a common and reliable component of the remedy to eliminate exposure to impacted groundwater and natural attenuation processes have demonstrated effective reduction in FDDA groundwater.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative would not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Confirmatory soil sampling and analysis is easily implementable to measure the effectiveness of the soil component of this alternative. Groundwater monitoring to demonstrate contaminant reduction is easily implementable. Treatment system effluent (if required) will be monitored on a routine basis to evaluate the effectiveness of the treatment system and document that discharge requirements are being met.
Ability to Obtain Approvals and Coordinate with Other Agencies	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Facilities are available to treat or dispose of the excavated material within the northeast. However, it is assumed that excavated soil will be reused on-site at one of the landfill lobes beneath the final cover system. If groundwater extraction and ex-situ treatment is implemented (through phased approach), discharge of the treated groundwater will be to surface water or the local POTW.
Availability of Necessary Equipment and Specialists	Equipment, materials and services for this alternative are readily available.
Availability of Technology	Qualified engineers and contractors are available to design and implement this alternative.
	COSTS - *net present value (7%)*
Capital Costs	$1,000,000
Annual Operation, Maintenance and Monitoring	$1,700,000
Periodic Costs	$110,000
TOTAL	$2,810,000

TABLE FDDA-5
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-5: Excavation, treatment and/or disposal of soil with groundwater extraction and ex-situ treatment for area-wide contaminant reduction

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The results of the human health risk assessment indicated that VOCs and SVOCs in soil may pose a potential risk to receptors. The potential for volatilization of select VOCs in groundwater may pose a potential risk to future site residents or facility workers. If groundwater is used as a source of potable water, groundwater in the FDDA may also pose a risk to future site residents or facility workers. Under this alternative, excavation of the impacted soil will be conducted to reduce concentrations to meet RAOs therefore eliminating the potential human health risks associated with the impacted soil and achieving site RAOs for soil. In addition to soil excavation, a groundwater extraction and treatment system for area-wide contaminant reduction/restoration and institutional controls will also be implemented to address impacted groundwater.
Ecological Protection	The results of the ecological risk assessment indicated that select SVOCs and VOCs in soil within the FDDA may pose potential risk to ecological receptors. Under this alternative, excavation of the impacted soil will be conducted to reduce concentrations to meet cleanup goals. Therefore the potential future risk to ecological receptors will be eliminated and RAOs for soil will be achieved.
COMPLIANCE WITH ARARs	
Chemical Specific	Potential chemical specific ARARs for this alternative are presented in Table E-2 in Appendix E; this alternative will be designed and implemented to comply with applicable chemical-specific ARARs.
Location Specific	Potential location specific ARARs for this alternative are presented in Table E-2 in Appendix E; this alternative will be designed and implemented to comply with applicable location-specific ARARs.
Action Specific	Action specific ARARs for this alternative are presented in Table E-2 in Appendix E; this alternative will be designed and implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Area-wide contaminant reduction of impacted groundwater through groundwater extraction and ex-situ treatment will significantly reduce residual risk, preventing downgradient exposure and actively treating impacted groundwater. In addition, removal of the impacted soil through excavation will significantly reduce any residual risk associated with the impacted soil. Therefore, residual risk is low compared to other alternatives.

TABLE FDDA-5
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-5: Excavation, treatment and/or disposal of soil with groundwater extraction and ex-situ treatment for area-wide contaminant reduction

EVALUATION CRITERIA	DETAILED ANALYSIS
Adequacy and Reliability of Controls	Excavation of impacted soil will provide long-term effectiveness and permanence since the material will be removed. Post excavation confirmatory soil samples will be collected to document the reliability of the alternative. Assuming effective implementation, institutional controls should effectively limit human exposure to impacted groundwater until groundwater RAOs are achieved. Monitoring of the extraction system's effectiveness in reducing contaminant mass will be required to measure the reliability of the groundwater component of this alternative.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	Treatment of the excavated soil may or may not be required prior to disposal; depending on the waste characterization results of the material being excavated, ex-situ treatment of soil may be implemented prior to disposal. Materials treated within groundwater through the extraction and ex-situ treatment system will include VOCs, SVOCs & metals via a combination of technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps (to be determined during remedial design phase).
Amount Destroyed or Treated	Treatment of a portion of the excavated soil may be required prior to disposal; however, the volume or concentrations will be dependent on waste characterization analysis. An estimated total extraction rate of 50 gpm of groundwater will be treated through the groundwater extraction and ex-situ treatment system. Current dissolved concentrations indicate an estimated 1,600 to 2,000 lbs of VOCs in FDDA groundwater available for treatment.
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	Treatment of a portion of the excavated soil may be required prior to disposal; however, the volume or concentrations will be dependent on waste characterization analysis. Compared to other alternatives evaluated for the FDDA, this alternative provides a moderate to high level of reduction in toxicity, mobility and volume of contaminants through groundwater treatment.
Degree to which Treatment is Irreversible	The groundwater and, if required, soil treatment will be permanent.
Type and Quantity of Residuals Remaining after Treatment	Through excavation of the impacted soil, no residuals presenting exposure risks will remain. Treatment of the groundwater plume and any resulting VOC vapors will result in a moderate to high volume of treatment residuals that will require off-site treatment/disposal at a licensed facility.
Degree to Which Treatment Reduces Principal Threats	Principal threats of soil exposure and potential leaching from soil to groundwater are not addressed via treatment for this alternative; however, through excavation, institutional controls, and groundwater extraction and treatment, the principal threats/ exposure risks will be eliminated over time.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	This alternative will not have significant short-term effects on the local community. Re-use/disposal of the material on-site is anticipated beneath the landfill final cover system; however, should off-site treatment be required, local truck/ vehicular traffic will increase during implementation.

TABLE FDDA-5
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-5: Excavation, treatment and/or disposal of soil with groundwater extraction and ex-situ treatment for area-wide contaminant reduction

EVALUATION CRITERIA	DETAILED ANALYSIS
Protection of Workers During Remedial Action	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.
Environmental Impacts	Impacts to the wetland resource areas are anticipated to be moderate to high during construction activities due to the location of the extraction wells and the excavation extent within and/or adjacent to the wetland resource area. Once the excavation is complete, the groundwater treatment system is installed, and the area restored, operation and monitoring activities are anticipated to have limited impacts. Available practical means such as erosion and stormwater control measures will also be implemented to minimize harm to wetland areas during construction.
Time Until Remedial Action Objectives are Achieved	Soil RAOs will be achieved upon removal of the impacted soil; confirmatory soil sampling will be performed to document the achievement of RAOs. The estimated time to achieve groundwater RAOs is approximately 23 to 85 years
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	Soil excavation involves common techniques that are straight forward to implement. Erosion controls will be required as part of the design and implementation to reduce environmental impacts to the adjacent wetlands. The installation of wells and piping for the groundwater treatment system involves common construction techniques; however due to the location of the impacted groundwater within and adjacent to the wetland resource area, this alternative poses difficulty in implementation to reduce environmental impacts and in designing the treatment system layout. Prior to implementation, pre-design pilot studies will be required to measure groundwater capture zones.
Reliability of the Technology	Excavation of impacted soil is a reliable technology to quickly and effectively eliminated exposure risks. Implementation of institutional controls is a common and reliable component of the remedy to control exposure to impacted groundwater. Contaminant mass reduction through groundwater extraction is a demonstrated and reliable method for capturing and collecting impacted groundwater. In addition, available ex-situ treatment components (are effective in treating groundwater to meet remedial goals.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Confirmatory soil sampling and analysis is easily implementable to measure the effectiveness of the soil component of this alternative. Groundwater monitoring to demonstrate contaminant reduction is easily implementable. Treatment system effluent will be monitored on a routine basis to evaluate the effectiveness of the treatment system and document that discharge requirements are being met.
Ability to Obtain Approvals and Coordinate with Other Agencies	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.

TABLE FDDA-5
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table FDDA-5: Excavation, treatment and/or disposal of soil with groundwater extraction and ex-situ treatment for area-wide contaminant reduction

EVALUATION CRITERIA	DETAILED ANALYSIS
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Facilities are available to treat or dispose of the excavated material within the northeast. However, it is assumed that excavated soil will be reused on-site at one of the landfill lobes beneath the final cover system. Discharge of the treated groundwater will be to surface water or the local POTW.
Availability of Necessary Equipment and Specialists	Equipment, materials and services for this alternative are readily available.
Availability of Technology	Qualified engineers and contractors are available to design and implement this alternative.
	COSTS - *net present value (7%)*
Capital Costs	$4,500,000
Annual Operation, Maintenance and Monitoring	$5,300,000 to $7,700,000
Periodic Costs	$130,000
TOTAL	$9,930,000 to $12,330,000

O&M cost range based on discharge method - low end to surface water, high end to POTW

TABLE GSA-1
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA
Table GSA-1: No Action

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The results of the human health risk assessment indicated that select metals and PAHs in soils may pose a potential future risk to site residents, facility workers and/or construction workers. Under this alternative, no remedial actions will be conducted to reduce concentrations of PAHs or metals in soil to cleanup goals. Therefore the potential future risk to site residents, facility workers and/or construction workers will remain and RAOs will not be achieved.
Ecological Protection	The results of the ecological risk assessment indicated that current and potential future risks to ecological receptors are present in soil in the GSA. Under this alternative, no remedial actions will be conducted to reduce concentrations in soil to cleanup goals. Therefore the potential future risk to ecological receptors will remain and RAOs will not be achieved.
COMPLIANCE WITH ARARs	
Chemical Specific	Under existing conditions, constituents in soil exceed chemical specific ARARs. Contaminant concentrations in soil are not anticipated to reduce over time; therefore, chemical specific ARARs will not be met for this alternative.
Location Specific	Location specific ARARs do not apply for this alternative since there are no remedial activities associated with this alternative that will cause adverse impacts to natural resources.
Action Specific	Action specific ARARs do not apply for this alternative since there are no remedial activities associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Since there are no active remedial actions or institutional controls associated with this alternative, potential future exposure to site residents, facility workers, construction workers and ecological receptors to contaminants in soil will continue to pose a potential residual risk.
Adequacy and Reliability of Controls	No controls are proposed for this alternative.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No active treatment is proposed for this alternative.
Amount Destroyed or Treated	None
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	No active treatment is proposed for this alternative, therefore, no reduction in toxicity, mobility or volume through treatment will be achieved.
Degree to which Treatment is Irreversible	No treatment is proposed.
Type and Quantity of Residuals Remaining after Treatment	Existing conditions will remain since no treatment is proposed.
Degree to Which Treatment Reduces Principal Threats	No treatment is proposed.

TABLE GSA-1
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table GSA-1: No Action

EVALUATION CRITERIA	DETAILED ANALYSIS
	SHORT-TERM EFFECTIVENESS
Protection of Community During Remedial Action	Not applicable since no remedial actions are included in this alternative.
Protection of Workers During Remedial Action	Not applicable since no remedial actions are included in this alternative.
Environmental Impacts	Not applicable since no remedial actions are included in this alternative.
Time Until Remedial Action Objectives are Achieved	No active remedial actions will be implemented to reduce concentrations in soil to RAOs. Therefore, RAO's will not be achieved through this alternative.
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	Not applicable since no remedial actions are included in this alternative.
Reliability of the Technology	Not applicable since no remedial actions are included in this alternative.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Not applicable since no remedial actions or monitoring are included in this alternative.
Ability to Obtain Approvals and Coordinate with Other Agencies	Not applicable since no remedial actions are included in this alternative; therefore, no approvals or coordination required.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Not applicable for this alternative.
Availability of Necessary Equipment and Specialists	No equipment or specialists required for this alternative.
Availability of Technology	Not applicable since no remedial technologies will be used.
	COSTS - *net present value (7%)*
Capital Costs	$0
Annual Operation, Maintenance and Monitoring	$40,000
Periodic Costs	$10,000
TOTAL	$50,000

TABLE GSA-2
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table GSA-2: Excavation with Treatment and/or Disposal of Soil

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The results of the human health risk assessment indicated that select metals and PAHs in soils may pose a potential future risk to site residents, facility workers and/or construction workers. Under this alternative, excavation of the impacted soil will be conducted to reduce concentrations to meet cleanup goals, therefore the potential future risk to site residents, facility workers and construction workers will be eliminated and RAOs will be achieved.
Ecological Protection	The results of the ecological risk assessment indicated that current and potential future risks to ecological receptors are present in soil in the GSA. Under this alternative, excavation of the impacted soil will be conducted to reduce concentrations to meet cleanup goals, therefore the potential future risk to ecological receptors will be eliminated and RAOs will be achieved.
COMPLIANCE WITH ARARs	
Chemical Specific	Under existing conditions, constituents in soil exceed chemical specific ARARs. This alternative will be designed and implemented to comply with the chemical specific ARARs.
Location Specific	Location specific ARARs do not apply for this alternative since there are no remedial activities associated with this alternative that will cause adverse impacts to natural resources.
Action Specific	Action specific ARARs for this alternative are presented in Table E-3 in Appendix E; this alternative will be designed and implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Removal of the impacted material through excavation will significantly reduce any residual risk.
Adequacy and Reliability of Controls	Excavation of impacted soil will provide long-term effectiveness and permanence since the material will be removed from the GSA and disposed of beneath the landfill final cover system. Post excavation confirmatory soil samples will be collected to document the reliability of the alternative.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	Treatment of the excavated soil may or may not be required prior to disposal; depending on the waste characterization results of the material being excavated, ex situ treatment of soil may be implemented prior to disposal.
Amount Destroyed or Treated	Treatment of a portion of the excavated soil may be required prior to disposal; however, the volume or concentrations will be dependent on waste characterization analysis.
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	No active treatment of the excavated material is anticipated for this alternative; however, through re-use/disposal of the material beneath a landfill cap, the toxicity, mobility and volume of impacted material in the GSA is significantly reduced.
Degree to which Treatment is Irreversible	No treatment is anticipated with this alternative.

TABLE GSA-2
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table GSA-2: Excavation with Treatment and/or Disposal of Soil

EVALUATION CRITERIA	DETAILED ANALYSIS
Type and Quantity of Residuals Remaining after Treatment	No active treatment of the excavated material is anticipated for this alternative.
Degree to Which Treatment Reduces Principal Threats	No active treatment of the excavated material is anticipated for this alternative; however, through excavation of the impacted material, the principal threats will be eliminated.
	SHORT-TERM EFFECTIVENESS
Protection of Community During Remedial Action	This alternative will not have significant short-term effects on the local community. Re-use/disposal of the material on-site is anticipated beneath the landfill final cover system; however, should off-site treatment be required, local truck/vehicular traffic will increase during implementation.
Protection of Workers During Remedial Action	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.
Environmental Impacts	Limited environmental impacts are anticipated.
Time Until Remedial Action Objectives are Achieved	RAOs will be achieved upon removal of the impacted soil (1 to 2 years); confirmatory soil sampling will be performed to document the achievement of RAOs.
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	Soil excavation involves common techniques that are straight forward to implement.
Reliability of the Technology	Excavation of impacted soil is a reliable technology to quickly and effectively control exposure risks.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Confirmatory soil sampling and analysis is easily implementable to measure the effectiveness of the remedy.
Ability to Obtain Approvals and Coordinate with Other Agencies	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Facilities are available to treat or dispose of the excavated material within the northeast. However, it is assumed that excavated soil will be reused on-site at one of the landfill lobes beneath the final cover system.
Availability of Necessary Equipment and Specialists	Equipment, materials and services for this alternative are readily available.
Availability of Technology	Qualified engineers and contractors are readily available to design and implement this alternative.
	COSTS - *net present value (7%)*
Capital Costs	$184,000
Annual Operation, Maintenance and Monitoring	$0
Periodic Costs	$16,000
TOTAL	$200,000

TABLE DGGW-1
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA
Table DGGW-1: No Action

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The results of the human health risk assessment indicated the potential risk through the potable use of site groundwater exists to future site residents and facility workers. Under this alternative, no remedial actions will be conducted to reduce residual concentrations in downgradient groundwater to RAOs. Therefore the potential future risk of potable groundwater use will remain and RAOs will not be achieved.
Ecological Protection	The results of the ecological risk assessment indicated no significant risks to ecological receptors as a result of downgradient groundwater.
COMPLIANCE WITH ARARs	
Chemical Specific	Under existing conditions, concentrations of select compounds in downgradient groundwater exceed chemical specific ARARs. No active treatment technologies are implemented with this alternative; therefore, chemical specific ARARs will not be met for this alternative.
Location Specific	Location specific ARARs do not apply for this alternative since there are no remedial activities associated with this alternative that will cause adverse impacts to natural resources.
Action Specific	Action specific ARARs do not apply for this alternative since there are no remedial activities associated with this alternative.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Since there are no active remedial actions or institutional controls associated with this alternative, potential future exposure to contaminants in groundwater will continue to pose a residual risk.
Adequacy and Reliability of Controls	No controls are proposed for this alternative.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	No active treatment is proposed for this alternative.
Amount Destroyed or Treated	No active treatment is proposed for this alternative.
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	No reduction in toxicity, mobility or volume through treatment will be achieved with this alternative.
Degree to which Treatment is Irreversible	No active treatment is proposed.
Type and Quantity of Residuals Remaining after Treatment	No active treatment is proposed.
Degree to Which Treatment Reduces Principal Threats	No active treatment is proposed and therefore the potential risks of groundwater consumption still remain.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	Not applicable since no remedial actions are included in this alternative.
Protection of Workers During Remedial Action	Not applicable since no remedial actions are included in this alternative.

TABLE DGGW-1
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA
Table DGGW-1: No Action

EVALUATION CRITERIA	DETAILED ANALYSIS
Environmental Impacts	Not applicable since no remedial actions are included in this alternative.
Time Until Remedial Action Objectives are Achieved	No active remedial actions will be implemented to reduce concentrations in downgradient groundwater to PRGs. Therefore, RAOs will not be achieved through this alternative.
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	Not applicable since no remedial actions are included in this alternative.
Reliability of the Technology	Not applicable since no remedial actions are included in this alternative.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Not applicable since no remedial actions or monitoring are included in this alternative.
Ability to Obtain Approvals and Coordinate with Other Agencies	Not applicable since no remedial actions are included in this alternative; therefore, no approvals or coordination required.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Not applicable for this alternative.
Availability of Necessary Equipment and Specialists	No equipment or specialists required for this alternative.
Availability of Technology	Not applicable since no remedial technologies will be used.
	COSTS - *net present value (7%)*
Capital Costs	$0
Annual Operation, Maintenance and Monitoring	$41,000
Periodic Costs	$43,000
TOTAL	$84,000

TABLE DGGW-2
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table DGGW-2: In-situ Remediation

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The results of the human health risk assessment indicated the potential risk through the potable use of site groundwater exists to future site residents and facility workers. Under this alternative, in-situ natural attenuation mechanisms will be monitored to address impacted groundwater following a phased approach to the groundwater remedy. Until the RAOs are achieved, institutional controls will be in place to prevent groundwater use/exposure, controlling human risks.
Ecological Protection	The results of the ecological risk assessment indicated no significant risks to ecological receptors as a result of downgradient groundwater.
COMPLIANCE WITH ARARs	
Chemical Specific	Under existing conditions, concentrations of select compounds in groundwater exceed chemical specific ARARs. Implementation of this alternative will be expected to reduce contaminant concentrations in downgradient groundwater and over time, achieve chemical-specific ARARs.
Location Specific	Potential location specific ARARs for this alternative are presented in Table E-4 in Appendix E; this alternative provides the least amount of disruption to ecological receptors and the wetland resource area during implementation. In-situ remedial activities can be implemented to comply with applicable location-specific ARARs.
Action Specific	Potential action specific ARARs for this alternative are presented in Table E-4 in Appendix E. In-situ remedial activities can be implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Until the achievement of site RAOs, implementation of institutional controls will reduce potential use and exposure to impacted groundwater. Therefore, residual risk is low.
Adequacy and Reliability of Controls	Assuming effective implementation and enforcement, institutional controls should effectively limit human exposure to impacted groundwater until the RAOs are achieved.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	Natural attenuation processes, including biodegradation, dispersion, dilution, adsorption, volatilization and/or chemical and biological stabilization or destruction of contaminants, will address groundwater COPCs in situ.
Amount Destroyed or Treated	Natural attenuation processes are anticipated to reduce the contaminants over time; current dissolved concentrations indicate an estimated 200 lbs of VOCs in downgradient groundwater.
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	Alternative does not include active treatment technologies. The degree to which this alternative will reduce the toxicity, mobility and volume of contaminants through natural attenuation is moderate, compared to other alternatives evaluated.
Degree to which Treatment is Irreversible	Alternative does not include active treatment technologies. Natural attenuation mechanisms are permanent.

TABLE DGGW-2
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA
Table DGGW-2: In-situ Remediation

EVALUATION CRITERIA	DETAILED ANALYSIS
Type and Quantity of Residuals Remaining after Treatment	No residuals will remain through in-situ natural attenuation processes.
Degree to Which Treatment Reduces Principal Threats	The principal threats/exposure risks from groundwater will be controlled/reduced through natural attenuation and institutional controls.
	SHORT-TERM EFFECTIVENESS
Protection of Community During Remedial Action	No impacts to the community are anticipated for this alternative.
Protection of Workers During Remedial Action	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.
Environmental Impacts	Impacts to the wetland resource areas are anticipated to be limited during monitoring activities.
Time Until Remedial Action Objectives are Achieved	RAOs will be achieved through natural attenuation processes; estimated timeframe of With Source Control - 67 to 79 years Without Source Control - 81 to 98 years
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	No construction activities are planned for this alternative other than installation of additional monitoring wells; monitoring activities are easily implementable.
Reliability of the Technology	Site characterization data indicate that natural attenuation processes are effectively degrading contaminants. Refer to Section 7.2 in the FS text for MNA discussion.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Groundwater sampling and analysis to evaluate contaminant levels is easily implementable.
Ability to Obtain Approvals and Coordinate with Other Agencies	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Not applicable for this alternative.
Availability of Necessary Equipment and Specialists	Equipment, materials and services for this alternative are readily available.
Availability of Technology	Qualified engineers and contractors are available to design and implement this alternative.
	COSTS - *net present value (7%)*
Capital Costs	$230,000
Annual Operation, Maintenance and Monitoring	$1,400,000
Periodic Costs	$120,000
TOTAL	$1,750,000

TABLE DGGW-3
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table DGGW-3: Hydraulic Containment through Groundwater Extraction, Treatment and Discharge

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The results of the human health risk assessment indicated the potential risk through the potable use of site groundwater exists to future site residents and facility workers. Under this alternative, hydraulic containment of impacted groundwater through groundwater extraction and ex-situ treatment will be implemented to control plume migration and meet RAOs over time. Until the RAOs are achieved, institutional controls will be in place to prevent groundwater use/exposure, controlling human risks.
Ecological Protection	The results of the ecological risk assessment indicated no significant risks to ecological receptors as a result of downgradient groundwater.
COMPLIANCE WITH ARARs	
Chemical Specific	Under existing conditions, concentrations of select compounds in groundwater exceed chemical specific ARARs. Implementation of this alternative will be expected to reduce contaminant concentrations in downgradient groundwater and over time, achieve chemical-specific ARARs.
Location Specific	Potential location specific ARARs for this alternative are presented in Table E-4 in Appendix E; this alternative will provide disruption to ecological receptors and the wetland resource area during implementation; however, the design, construction and operation of this alternative can be implemented to comply with applicable location-specific ARARs.
Action Specific	Potential action specific ARARs for this alternative are presented in Table E-4 in Appendix E; the design, construction and operation of this alternative can be implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Until the achievement of site RAOs implementation of institutional controls will reduce potential use and exposure to impacted groundwater. Therefore, residual risk is low.
Adequacy and Reliability of Controls	Assuming effective implementation and enforcement, institutional controls should effectively limit human exposure to impacted groundwater until the RAOs are achieved. Monitoring of the extraction system's effectiveness in hydraulically containing the plume will be required to measure the reliability of the alternative. Extraction and treatment system components will require maintenance, upkeep and potentially replacement overtime to ensure reliability.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	Materials treated within groundwater through the hydraulic containment extraction and ex-situ treatment system will include VOCs, SVOCs & metals via a combination of technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps (to be determined during remedial design phase).
Amount Destroyed or Treated	An estimated total extraction rate of 75 gpm of groundwater will be treated through the hydraulic containment groundwater extraction and ex-situ treatment system. Current dissolved concentrations indicate an estimated 200 lbs of VOCs in downgradient groundwater available for treatment.

TABLE DGGW-3
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table DGGW-3: Hydraulic Containment through Groundwater Extraction, Treatment and Discharge

EVALUATION CRITERIA	DETAILED ANALYSIS
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	The degree to which this alternative will reduce the toxicity and mobility of contaminants is high and the degree to which it will reduce the volume of contaminants is moderate, compared to other DGGW alternatives evaluated.
Degree to which Treatment is Irreversible	Treatment of groundwater will be permanent.
Type and Quantity of Residuals Remaining after Treatment	Treatment of the groundwater plume and any resulting VOC vapors will produce a moderate volume of treatment residuals that may require off-site treatment/disposal at a licensed facility.
Degree to Which Treatment Reduces Principal Threats	In conjunction with institutional controls, upon treatment of contaminants in groundwater, the potential human risks to on-site downgradient groundwater will be eliminated.
	SHORT-TERM EFFECTIVENESS
Protection of Community During Remedial Action	Construction and operation of an on-site groundwater treatment facility will not have significant short-term impacts on the local community; however, there may be a slight increase in vehicular traffic to the site during construction activities.
Protection of Workers During Remedial Action	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.
Environmental Impacts	Impacts to the wetland resource areas are anticipated to be moderate to high during construction activities due to the location of the extraction wells within the resource area (requiring destruction of wetlands to install - estimated at 5,050 sq ft). Once the system is installed, operation and monitoring activities is anticipated to have limited impacts. Available practical means such as erosion and stormwater control measures will also be implemented to minimize harm to wetland areas during construction.
Time Until Remedial Action Objectives are Achieved	The estimated time to achieve groundwater RAOs is approximately With Source Control - 57 to 68 years Without Source Control - 70 to 86 years
	IMPLEMENTABILITY
Ability to Construct and Operate the Technology	The installation of wells and piping involves common construction techniques; however due to the location of the impacted groundwater within the wetland resource area, this alternative poses difficulty in implementation to reduce environmental impacts and in designing the treatment system layout (access roads to extraction wells, burial of extraction and electrical lines, etc.). Prior to implementation, pre-design pilot studies will be required to evaluate groundwater capture zones.
Reliability of the Technology	Groundwater extraction is a demonstrated and reliable method for capturing and collecting impacted groundwater. In addition, the ex-situ treatment components are effective in treating groundwater to the remedial goals.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Groundwater monitoring to demonstrate hydraulic containment and to determine contaminant levels is easily implementable. Treatment system effluent will be monitored on a routine basis to evaluate the effectiveness of the treatment system and document that discharge requirements are being met.
Ability to Obtain Approvals and Coordinate with Other Agencies	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.

TABLE DGGW-3
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table DGGW-3: Hydraulic Containment through Groundwater Extraction, Treatment and Discharge

EVALUATION CRITERIA	DETAILED ANALYSIS
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Discharge of the treated groundwater will be to surface water or the local POTW.
Availability of Necessary Equipment and Specialists	Equipment, materials and services for this alternative are readily available.
Availability of Technology	Qualified engineers and contractors are available to design and implement this alternative.
COSTS - *net present value (7%)*	
Capital Costs	$2,900,000
Annual Operation, Maintenance and Monitoring	$6,800,000 to $9,800,000
Periodic Costs	$130,000
TOTAL	$9,830,000 to $12,830,000

DGGW-3 O&M Range incorporates: 30 years of system operation with 30 years of groundwater monitoring - low: discharge to surface water, high: discharge to POTW

TABLE DGGW-4
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table DGGW-4: Groundwater Extraction and Ex-situ Treatment for Area-wide Contaminant Reduction

EVALUATION CRITERIA	DETAILED ANALYSIS
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	
Human Health Protection	The results of the human health risk assessment indicated the potential risk through the potable use of site groundwater exists to future site residents and facility workers. Under this alternative, groundwater extraction and ex-situ treatment for area-wide contaminant reduction will be implemented to control plume migration and aggressively treat groundwater to meet RAOs in an expedited timeframe. Until the RAOs are achieved, institutional controls will be in place to prevent groundwater use/exposure, controlling human risks.
Ecological Protection	The results of the ecological risk assessment indicated no significant risks to ecological receptors as a result of downgradient groundwater.
COMPLIANCE WITH ARARs	
Chemical Specific	Under existing conditions, concentrations of select compounds in groundwater exceed chemical specific ARARs. Implementation of this alternative will be expected to reduce contaminant concentrations in downgradient groundwater and over time, achieve chemical-specific ARARs.
Location Specific	Potential location specific ARARs for this alternative are presented in Table E-4 in Appendix E; this alternative will provide significant disruption to ecological receptors and the wetland resource area during implementation. However, the design, construction and operation of this alternative can be implemented to comply with applicable location-specific ARARs.
Action Specific	Potential action specific ARARs for this alternative are presented in Table E-4 in Appendix E; the design, construction and operation of this alternative can be implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE	
Magnitude of Residual Risk	Until the achievement of site RAOs implementation of institutional controls will reduce potential use and exposure to impacted groundwater. Therefore, residual risk is low.
Adequacy and Reliability of Controls	Assuming effective implementation and enforcement, institutional controls should effectively limit human exposure to impacted groundwater until the RAOs are achieved. The groundwater treatment system will adequately and reliably reduce the concentrations in downgradient groundwater. Extraction and treatment system components will require maintenance, upkeep and potentially replacement overtime to ensure reliability over time.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT	
Treatment Process Used and Materials Treated	Materials treated within groundwater through the hydraulic containment extraction and ex-situ treatment system will include VOCs, SVOCs & metals via a combination of technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps (to be determined during remedial design phase).
Amount Destroyed or Treated	An estimated total extraction rate of 140 gpm of groundwater will be treated through the groundwater extraction and ex-situ treatment system. Current dissolved concentrations indicate an estimated 200 lbs of VOCs in downgradient groundwater available for treatment.

TABLE DGGW-4
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table DGGW-4: Groundwater Extraction and Ex-situ Treatment for Area-wide Contaminant Reduction

EVALUATION CRITERIA	DETAILED ANALYSIS
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	Compared to other alternatives evaluated for downgradient groundwater, this alternative provides a high level of reduction in toxicity, mobility and volume of contaminants through ex-situ treatment.
Degree to which Treatment is Irreversible	Treatment of groundwater will be permanent.
Type and Quantity of Residuals Remaining after Treatment	Treatment of the groundwater plume and any resulting VOC vapors may produce a high volume of treatment residuals that will require off-site treatment/disposal at a licensed facility.
Degree to Which Treatment Reduces Principal Threats	In conjunction with institutional controls, upon treatment of contaminants in groundwater, the potential human risks to on-site downgradient groundwater will be eliminated.
SHORT-TERM EFFECTIVENESS	
Protection of Community During Remedial Action	Construction and operation of an on-site groundwater treatment facility will not have significant short-term impacts on the local community; however, there may be a slight increase in vehicular traffic to the site during construction activities.
Protection of Workers During Remedial Action	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.
Environmental Impacts	Impacts to the wetland resource areas are anticipated to be high during construction activities due to the location of the extraction wells within the resource area (requiring destruction of almost an acre of wetlands to install). Once the system is installed, operation and monitoring activities are anticipated to have limited to no impacts. Available practical means such as erosion and stormwater control measures will also be implemented to minimize harm to wetland areas during construction.
Time Until Remedial Action Objectives are Achieved	The estimated time to achieve groundwater RAOs is approximately With Source Control - 40 to 49 years Without Source Control - 53 to 66 years
IMPLEMENTABILITY	
Ability to Construct and Operate the Technology	The installation of wells and piping involves common construction techniques; however due to the location of the impacted groundwater within the wetland resource area, this alternative poses difficulty in implementation to reduce environmental impacts and in designing the treatment system layout (access roads to extraction wells, burial of extraction and electrical lines, etc.). Prior to implementation, pre-design pilot studies will be required to evaluate adequate groundwater capture zones.
Reliability of the Technology	Groundwater extraction is a demonstrated and reliable method for capturing and collecting impacted groundwater. In addition, the ex-situ treatment components are effective in treating groundwater to the remedial goals.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Groundwater monitoring to demonstrate hydraulic containment and to determine contaminant levels is easily implementable. Treatment system effluent will be monitored on a routine basis to evaluate the effectiveness of the treatment system and document that discharge requirements are being met.
Ability to Obtain Approvals and Coordinate with Other Agencies	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.

TABLE DGGW-4
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVE
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table DGGW-4: Groundwater Extraction and Ex-situ Treatment for Area-wide Contaminant Reduction

EVALUATION CRITERIA	DETAILED ANALYSIS
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Discharge of the treated groundwater will be to surface water or the local POTW.
Availability of Necessary Equipment and Specialists	Equipment, materials and services for this alternative are readily available.
Availability of Technology	Qualified engineers and contractors are available to design and implement this alternative.
	COSTS - ***net present value (7%)***
Capital Costs	$4,500,000
Annual Operation, Maintenance and Monitoring	$6,500,000 to $12,200,000
Periodic Costs	$130,000
TOTAL	$11,130,000 to $16,830,000

DGGW-4 O&M Range incorporates: Low - 30 years of system operation (discharge to surface water) with 30 years of groundwater monitoring and High: 30 years of system operation (discharge to POTW) with 30 years of groundwater monitoring

TABLE K-1
COMPARATIVE ANALYSIS FOR THE LANDFILL LOBE REMEDIAL ALTERNATIVES
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

EVALUATION CRITERIA	LF-1	LF-2a and LF-2b	LF-3	LF-4
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT				
Human Health Protection	The potential human health risks **will remain** and RAOs will **not** be achieved.	The potential human health risks **will be eliminated and** RAOs will be achieved.	The potential human health risks **will be eliminated** and RAOs will be achieved.	The potential human health risks **will be eliminated** and RAOs will be achieved.
Ecological Protection	The potential future risk to ecological receptors **will remain** and RAOs will **not** be achieved.	The potential future risk to ecological receptors **will be eliminated** and RAOs will be achieved.	The potential future risk to ecological receptors **will be eliminated** and RAOs will be achieved.	The potential future risk to ecological receptors **will be eliminated** and RAOs will be achieved.
COMPLIANCE WITH ARARs				
Chemical Specific	Chemical specific ARARs will not be met for this alternative in a timely manner.	This alternative will meet the RAOs and therefore comply with the chemical specific ARARs.	This alternative will meet the RAOs and therefore comply with the chemical specific ARARs.	This alternative will meet the RAOs and therefore comply with the chemical specific ARARs.
Location Specific	Location specific ARARs do not apply for this alternative.	This alternative will be designed and implemented to comply with applicable location-specific ARARs.	This alternative will be designed and implemented to comply with applicable location-specific ARARs.	This alternative **may not** meet applicable location-specific ARARs, specific to the amount of work in the wetland resource areas.
Action Specific	Action specific ARARs do not apply for this alternative.	This alternative will be designed and implemented to comply with applicable action-specific ARARs.	This alternative will be designed and implemented to comply with applicable action-specific ARARs.	This alternative will be designed and implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE				
Magnitude of Residual Risk	Potential future exposure to contaminants in waste, sediment, surface water and groundwater will continue to pose a potential residual risk.	Residual risk is low; comparable to LF-3 and LF-4.	Residual risk is low; comparable to LF-2 and LF-4.	Residual risk is low; comparable to LF-2 and LF-3.
Adequacy and Reliability of Controls	No controls proposed.	LF-2 prevents exposure to the waste, reduces infiltration through the waste into groundwater, prevents or reduces the potential for re-contamination of the brook, and limits human exposure to impacted groundwater until groundwater RAOs are achieved. Containment of groundwater utilizing a vertical barrier (in conjunction with monitored natural attenuation (LF-2a) or active groundwater treatment (LF-2b)) is anticipated to effectively and reliably limit human exposure to impacted groundwater until RAOs are met.	LF-3 prevents exposure to the waste, reduces infiltration through the waste into groundwater, prevents or reduces the potential for re-contamination of the brook, and limits human exposure to impacted groundwater until groundwater RAOs are achieved. Collection of groundwater with ex-situ treatment is anticipated to effectively and reliably limit human exposure to impacted groundwater until RAOs are met.	LF-4 prevents exposure to the waste, reduces infiltration through the waste into groundwater, prevents or reduces the potential for re-contamination of the brook, and limits human exposure to impacted groundwater until groundwater RAOs are achieved. Containment of groundwater utilizing a vertical barrier (in conjunction with active groundwater treatment) is anticipated to effectively and reliably limit human exposure to impacted groundwater until RAOs are met.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT				
Treatment Process Used and Materials Treated	No active treatment is proposed.	Materials addressed in groundwater include VOCs, SVOCs & metals. Alternative LF-2a does not actively treat groundwater. MNA processes will address COCs in-situ following a phased approach to the groundwater remedy. Alternative LF-2b will treat these COCs in-situ (e.g., chemical oxidation) or if extraction and ex-situ treatment is implemented, a combination of technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps (to be determined during the design phase) will be used.	Materials treated in groundwater include VOCs, SVOCs & metals; a combination of technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps (to be determined during the design phase) will be utilized to treat the COCs extracted.	Same as LF-2b.
Amount Destroyed or Treated	None	Current dissolved concentrations indicate an estimated *2,700 to 4,500 lbs of VOCs in Northern and Southern* lobe groundwater.	*Same as LF-2 and LF-4.*	Same as LF-2b and LF-3.

TABLE K-1
COMPARATIVE ANALYSIS FOR THE LANDFILL LOBE REMEDIAL ALTERNATIVES
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

EVALUATION CRITERIA	LF-1	LF-2a and LF-2b	LF-3	LF-4
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	No reduction in toxicity, mobility or volume through treatment will be achieved.	Compared to other alternatives evaluated for the landfill lobes, this alternative provides a **low** (LF-2a) **to moderate** (LF-2b) level of reduction in toxicity, mobility and volume of contaminants through treatment.	Compared to other alternatives evaluated for the landfill lobes, this alternative provides, through groundwater treatment, a **moderate** level of reduction in toxicity and volume and a high level of reduction with regard to mobility of contaminants.	Same as LF-2b.
Degree to which Treatment is Irreversible	No treatment is proposed.	Alternative LF-2a does not include treatment technologies. Under Alternative LF-2b, the groundwater treatment will be permanent.	Same as LF-2b and LF-4.	Same as LF-2b and LF-3.
Type and Quantity of Residuals Remaining after Treatment	Existing conditions will remain since no treatment is proposed.	MNA process will address COCs in-situ. Low volume of residuals anticipated following groundwater treatment (LF-2b).	**Moderate to high** volume of residuals anticipated following groundwater treatment.	Same as LF-2b.
Degree to Which Treatment Reduces Principal Threats	No treatment is proposed.	Overall, this alternative presents a high degree of reducing principal threats since in-situ natural attenuation process with or without enhancements (LF-2a) or active treatment (LF-2b) will address groundwater impacts and in conjunction with the physical barrier, will prevent re-contamination of the brook.	Overall, this alternative presents a high degree of reducing principal threats through treatment since it extracts and treats a large volume of impacted groundwater.	Same as LF-2b.
SHORT-TERM EFFECTIVENESS				
Protection of Community During Remedial Action	Not applicable.	**Limited** short-term effects anticipated.	**Moderate** short-term effects anticipated; slight increase over LF-2 due to longer construction timeframe (for groundwater components).	**Higher** short-term effects anticipated due to the lengthier construction timeframe (re-routing brook and wetlands replication).
Protection of Workers During Remedial Action	Not applicable.	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.	Same as LF-2 and LF-4.	Same as LF-2 and LF-3.
Environmental Impacts	Not applicable.	Impacts to the wetland resource areas are anticipated to be **moderate** during construction activities due to the location of the wetland resource areas surrounding the landfill lobes and during the brook excavation, temporary re-directing/routing of the brook may be required to effectively remove the impacted sediment, potentially causing disruption to the existing ecological habitat.	Similar to LF-2, with a slightly higher area of impact due to the groundwater component.	Impacts to the wetland resource areas are anticipated to be **high** during construction activities due to the destruction of the existing wetland/marsh area to the south of the southern lobe during the brook re-creation (disrupting ecological habitat) and due to the location of the wetland resource areas surrounding the landfill lobes (erosion controls and stormwater management will be required to reduce impacts).
Time Until Remedial Action Objectives are Achieved	RAO's **will not be achieved** through this alternative.	65 to 210 years	52 to 164 years	65 to 210 years
IMPLEMENTABILITY				
Ability to Construct and Operate the Technology	Not applicable.	This alternative involves common construction techniques; however the presence of wetland resource areas and the adjacent 100-year flood plain may present potential design challenges. This alternative provides a **reduced** level of operation, maintenance and monitoring than LF-3.	This alternative involves common construction techniques; however the presence of wetland resource areas and the adjacent 100-year flood plain may present potential design challenges. This alternative provides a **higher** level of operation, maintenance and monitoring than other alternatives evaluated (e.g. LF-2 and LF-4).	In general, this alternative involves common construction techniques; however the presence of wetland resource areas and the 100-year flood plain **will present potential design challenges**. In addition, implementation/construction of re-routing the brook **will present access and habitat disruption** issues.

TABLE K-1
COMPARATIVE ANALYSIS FOR THE LANDFILL LOBE REMEDIAL ALTERNATIVES
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

EVALUATION CRITERIA	LF-1	LF-2a and LF-2b	LF-3	LF-4
Reliability of the Technology	Not applicable.	The combination of technologies that this alternative incorporates presents a reliable approach to comply with ARARs and achieve RAOs.	Same as LF-2.	The combination of technologies that this alternative incorporates presents a reliable approach to achieve RAOs; however due to the issues associated with re-routing the brook (i.e. recreating function and value of resource areas on-site and finding available space on-site), this alternative is not as reliable as the other alternatives to meet RAOs.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.	This alternative should not limit or interfere with the ability to implement or perform future remedial actions.	Similar to LF-2 and LF-4.	Similar to LF-2 and LF-3.
Ability to Monitor Effectiveness of Remedy	Not applicable.	Confirmatory sediment sampling and analysis is easily implementable to measure the effectiveness of the brook sediment excavation. Groundwater monitoring to demonstrate contaminant containment and mass reduction is easily implementable.	Same as LF-2 and LF-4.	Same as LF-2 and LF-3.
Ability to Obtain Approvals and Coordinate with Other Agencies	Not applicable since no remedial actions are included in this alternative; therefore, no approvals or coordination required.	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.	Same as LF-2.	With the potential ARAR issues in regards to the Massachusetts Wetlands Act, this alternative may have difficulty obtaining approval (i.e., substantial compliance).
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Not applicable for this alternative.	Facilities are available to treat or dispose of the excavated material within Massachusetts. However, there is also availability to re-use this material on-site at one of the landfill lobes beneath the final cover system. If groundwater extraction and ex-situ treatment are implemented, the treated groundwater can be discharged to surface water or to the local POTW.	Similar to LF-2 and LF-4.	Similar to LF-2 and LF-3.
Availability of Necessary Equipment and Specialists	No equipment or specialists required for this alternative.	Equipment, materials and services for this alternative are readily available.	Same as LF-2 and LF-4.	Similar to LF-2 and LF-3.
Availability of Technology	Not applicable since no remedial technologies will be used.	Qualified engineers and contractors are available to design and implement this alternative.	Same as LF-2 and LF-4.	Similar to LF-2 and LF-3.
COSTS - *net present value (7%) - 30 years*				
Capital Costs	$0	$17,500,000 LF-2a to $19,700,000 LF-2b	$24,900,000	$25,900,000
Annual Operation, Maintenance and Monitoring	$68,000	$2,900,000 LF-2a to $5,400,000 LF-2b	$15,900,000 to $26,100,000	$5,400,000
Periodic Costs	$43,000	$120,000	$130,000	$120,000
TOTAL	$111,000	$20,520,000 LF-2a to $25,220,000 LF-2b	$40,930,000 to $51,130,000	$31,420,000

TABLE K-2
COMPARATIVE ANALYSIS FOR THE FORMER DRUM DISPOSAL AREA REMEDIAL ALTERNATIVES
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

Table K-2

EVALUATION CRITERIA	FDDA-1	FDDA-2	FDDA-3	FDDA-4	FDDA-5
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT					
Human Health Protection	The potential future risks will remain.	This alternative **controls** the potential future risks through containment.	This alternative **eliminates** the potential future risks.	This alternative **eliminates** the potential future risks.	This alternative **eliminates** the potential future risks.
Ecological Protection	The potential future risks will remain.	The potential future risks will be **controlled** through containment.	The potential future risks will be **eliminated.**	The potential future risks will be **eliminated.**	The potential future risks will be **eliminated.**
COMPLIANCE WITH ARARs					
Chemical Specific	Chemical specific ARARs will not be met for this alternative.	This alternative will prevent exposure to the impacted material, but may not meet the RAOs in soil and therefore **may not** comply with the chemical specific ARARs in the foreseeable future.	This alternative will meet the RAOs over time and therefore comply with the chemical specific ARARs.	This alternative will meet the RAOs over time and therefore comply with the chemical specific ARARs.	This alternative will meet the RAOs over time and therefore comply with the chemical specific ARARs.
Location Specific	Location specific ARARs do not apply for this alternative.	This alternative will be designed and implemented to comply with applicable location-specific ARARs.	This alternative will be designed and implemented to comply with applicable location-specific ARARs.	This alternative will be designed and implemented to comply with applicable location-specific ARARs.	This alternative will be designed and implemented to comply with applicable location-specific ARARs.
Action Specific	Action specific ARARs do not apply for this alternative.	This alternative will be designed and implemented to comply with applicable action-specific ARARs.	This alternative will be designed and implemented to comply with applicable action-specific ARARs.	This alternative will be designed and implemented to comply with applicable action-specific ARARs.	This alternative will be designed and implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE					
Magnitude of Residual Risk	Potential future exposure to contaminants in soil will continue to pose a potential residual risk.	Hydraulic containment of impacted groundwater will significantly reduce residual risk; however, the impacted soil will remain (beneath the containment barrier), providing the potential for future leaching into groundwater over time. Therefore, residual risk is **relatively high,** compared to FDDA-3 through FDDA-5.	Hydraulic containment of impacted groundwater will significantly reduce residual risk. In addition, removal of the impacted soil through excavation will significantly reduce any residual risk associated with the impacted soil. Therefore, residual risk is **low** compared to FDDA-1 and FDDA-2 and comparable to FDDA-5.	Removal of the impacted soil through excavation will significantly reduce any residual risk associated with the impacted soil. A phased groundwater remedial action will further reduce residual risk over time. Therefore, residual risk is low to moderate compared to the other alternatives.	Similar to FDDA-3.
Adequacy and Reliability of Controls	No controls proposed.	Institutional controls should effectively limit human exposure to impacted soil and groundwater. Monitoring of the extraction system's effectiveness in hydraulically containing the plume will be required to determine the reliability of the groundwater component of this alternative and routine monitoring that the containment barrier is intact will be required to determine the reliability of the soil component of this alternative.	Excavation of impacted soil will provide long-term effectiveness and permanence since the material will be removed. Institutional controls should effectively limit human exposure to impacted groundwater until groundwater RAOs are achieved. Monitoring of the extraction system's effectiveness in hydraulically containing the plume will be required to determine the reliability of the groundwater component of this alternative.	Excavation of impacted soil will provide long-term effectiveness and permanence since the material will be removed. Institutional controls should effectively limit human exposure to impacted groundwater until groundwater RAOs are achieved through natural attenuation with or without enhancements. Monitoring will be required to determine the reliability of the groundwater component of this alternative.	Similar to FDDA-3.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT					
Treatment Process Used and Materials Treated	No active treatment is proposed for this alternative.	Materials treated within groundwater include VOCs, SVOCs and metals via a combination of technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps (to be determined during remedial design phase).	Treatment of the excavated soil may or may not be required prior to disposal; depending on the waste characterization sampling results. Materials treated within groundwater include VOCs, SVOCs and metals via a combination of technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps (to be determined during remedial design phase).	Treatment of the excavated soil may or may not be required prior to disposal; depending on the waste characterization sampling results. Natural attenuation processes, including biodegradation, dispersion, dilution, adsorption, volatilization and/or chemical and biological stabilization or destruction of contaminants, will address impacted groundwater (VOCs, SVOCs and metals). Following the phased approach, this alternative may also include MNA enhancements, other in-situ treatment components, or groundwater extraction and treatment. If implemented, the in-situ or ex-situ treatment system will treat groundwater via a combination of technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps (to be determined during design phase).	Same as FDDA-3.

TABLE K-2
COMPARATIVE ANALYSIS FOR THE FORMER DRUM DISPOSAL AREA REMEDIAL ALTERNATIVES
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

EVALUATION CRITERIA	FDDA-1	FDDA-2	FDDA-3	FDDA-4	FDDA-5
Amount Destroyed or Treated	None	No soil will be treated, but an estimated total extraction rate of 20 gpm of groundwater will be treated through the groundwater extraction and ex-situ treatment system. Current dissolved concentrations indicate an estimated 1,600 to 2,000 lbs of VOCs in FDDA groundwater available for treatment. With the soil remaining in-situ, the potential exists for future leaching of additional contaminants from soil to groundwater.	Treatment of a portion of the excavated soil may be required prior to disposal; however, the volume or concentrations will be dependent on waste characterization analysis. An estimated total extraction rate of 24 gpm of groundwater will be treated through the groundwater extraction and ex-situ treatment system. Current dissolved concentrations indicate an estimated 1,600 to 2,000 lbs of VOCs in FDDA groundwater available for treatment.	Treatment of a portion of the excavated soil may be required prior to disposal; however, the volume or concentrations will be dependent on waste characterization analysis. Current dissolved concentrations indicate an estimated 1,600 to 2,000 lbs of VOCs in FDDA groundwater. Natural attenuation processes with or without enhancements will address the dissolved plume. Following the phased groundwater approach, and in-situ treatment system or a groundwater extraction and ex-situ treatment system may be implemented (estimated total extraction rate of 15 gpm of groundwater).	Similar to FDDA-3, but with an anticipated extraction rate of 50 gpm.
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	No active treatment is proposed for this alternative, therefore, no reduction in toxicity, mobility or volume through treatment will be achieved with this alternative.	Compared to other alternatives evaluated for the FDDA, this alternative provides a **low** level of reduction in toxicity and volume of contaminants and a **high** level of reduction in mobility of contaminants.	Compared to other alternatives evaluated for the FDDA, this alternative provides a **moderate** level of reduction in toxicity, mobility and volume of contaminants through groundwater (and potentially soil) treatment.	Compared to other alternatives evaluated for the FDDA, this alternative provides a **lower** level of reduction in toxicity, mobility and volume of contaminants through groundwater (and potentially soil) treatment.	Compared to other alternatives evaluated for the FDDA, this alternative provides a **moderate to high** level of reduction in toxicity, mobility and volume of contaminants through groundwater (and potentially soil) treatment.
Degree to which Treatment is Irreversible	No treatment is proposed.	No soil will be actively treated. The groundwater treatment will be permanent.	The groundwater and, if required, soil treatment will be permanent.	If required, the groundwater and soil treatment will be permanent.	Same as FDDA-3.
Type and Quantity of Residuals Remaining after Treatment	Existing conditions will remain since no treatment is proposed.	Treatment of the groundwater plume and any resulting VOC vapors will result in a low to moderate volume of treatment residuals that will require off-site treatment/disposal at a licensed facility.	Similar to FDDA-2.	Limited to no residuals remaining after treatment.	Slightly higher residuals than other alternatives evaluated.
Degree to Which Treatment Reduces Principal Threats	No treatment is proposed.	Principal threats of soil exposure and potential leaching from soil to groundwater are not addressed via treatment for this alternative; however, in conjunction with institutional controls and construction of the containment barrier, the treatment of contaminants in groundwater will control the principal threats/ exposure risks over time.	Principal threats of soil exposure and potential leaching from soil to groundwater are not addressed via treatment for this alternative; however, through excavation, institutional controls, groundwater extraction and treatment, the principal threats/ exposure risks will be controlled over time.	Through excavation, institutional controls. and natural attenuation process, the principal threats/exposure risks will be controlled over time.	Similar to FDDA-3.
SHORT-TERM EFFECTIVENESS					
Protection of Community During Remedial Action	Not applicable.	Construction activities are not anticipated to have significant short-term impacts on the local community; however, there may be a slight increase in vehicular traffic to the site during construction activities.	This alternative will not have significant short-term effects on the local community. Re-use/disposal of the material on-site is anticipated beneath the landfill final cover system; however, should off-site treatment be required, local truck/vehicular traffic may be increased during implementation.	Similar to FDDA-3 and FDDA-5.	Similar to FDDA-3 and FDDA-4.
Protection of Workers During Remedial Action	Not applicable.	Comparable to other alternatives; slightly reduced exposure risk during implementation since soil remains in-place.	Comparable to alternatives FDDA-4 and FDDA-5.	Comparable to alternatives FDDA-3 and FDDA-5.	Comparable to alternatives FDDA-3 and FDDA-4.
Environmental Impacts	Not applicable.	Impacts to the wetland resource areas are anticipated to be **moderate**, compared to other alternatives evaluated.	Impacts to the wetland resource areas are anticipated to be **moderate**, compared to other alternatives evaluated.	Impacts to the wetland resource areas are anticipated to be **low to moderate**, compared to other alternatives evaluated.	Impacts to the wetland resource areas are anticipated to be **moderate to high**, compared to other alternatives evaluated.
Time Until Remedial Action Objectives are Achieved	RAO's **will not be achieved** through this alternative.	30 to 134 years	24 to 89 years	36 to 103 years	23 to 85 years

TABLE K-2
COMPARATIVE ANALYSIS FOR THE FORMER DRUM DISPOSAL AREA REMEDIAL ALTERNATIVES
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

EVALUATION CRITERIA	FDDA-1	FDDA-2	FDDA-3	FDDA-4	FDDA-5
IMPLEMENTABILITY					
Ability to Construct and Operate the Technology	Not applicable.	Comparable to other alternatives; slightly higher difficulty in construction of the soil barrier due to the proximity of the resource area and in designing the barrier due to the potential future use of the FDDA as a Northern lobe stormwater management basin.	Comparable to other alternatives; slightly higher level of disruption and difficulty constructing the groundwater extraction system components within or immediately adjacent to the wetland resource areas.	Comparable to other alternatives; less disruption and difficulty constructing within or immediately adjacent to the wetland resource areas.	Comparable to alternative FDDA-3, with a slightly higher level of disruption due to the wetland resource areas.
Reliability of the Technology	Not applicable.	Reduced reliability than FDDA-3 through FDDA-5 since source material remains in place.	Comparable to FDDA-4 and FDDA-5; higher reliability than FDDA-1 and FDDA-2.	Comparable to FDDA-3 and FDDA-5; higher reliability than FDDA-1 and FDDA-2.	Comparable to FDDA-3 and FDDA-4; higher reliability than FDDA-1 and FDDA-2.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.	Utilizing the area as a stormwater management basin for the Northern lobe final cover system and leaving the soil in place will present difficulty in undertaking additional remedial actions due to access restrictions.	This alternative would not limit or interfere with the ability to implement or perform future remedial actions; same as FDDA-4 and FDDA-5.	Same as FDDA- 3 and FDDA-5.	Same as FDDA-3 and FDDA-4.
Ability to Monitor Effectiveness of Remedy	Not applicable.	Groundwater monitoring to demonstrate contaminant reduction is easily implementable. Treatment system effluent will be monitored on a routine basis to evaluate the effectiveness of the treatment system and document that discharge requirements are being met. Routine inspection of the containment barrier is easily implementable as well.	Confirmatory soil sampling and analysis is easily implementable to measure the effectiveness of the soil component of this alternative. Groundwater monitoring to demonstrate contaminant reduction is easily implementable. Treatment system effluent will be monitored on a routine basis to evaluate the effectiveness of the treatment system and document that discharge requirements are being met.	Confirmatory soil sampling and analysis is easily implementable to measure the effectiveness of the soil component of this alternative. Groundwater monitoring to demonstrate contaminant reduction is easily implementable.	Same as FDDA-3.
Ability to Obtain Approvals and Coordinate with Other Agencies	Not applicable.	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.	Same as FDDA-2, FDDA-4 and FDDA-5.	Same as FDDA-2, FDDA-3 and FDDA-5.	Same as FDDA-2 through FDDA-4.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Not applicable.	No off-site treatment, storage or disposal services required for the soil component of the alternative. Discharge of the treated groundwater will be to surface water or the local POTW.	Facilities are available to treat or dispose of the excavated material within the northeast. However, it is assumed that excavated soil will be reused on-site at one of the landfill lobes beneath the final cover system. Discharge of the treated groundwater will be to surface water or the local POTW.	Facilities are available to treat or dispose of the excavated material within the northeast. However, it is assumed that excavated soil will be reused on-site at one of the landfill lobes beneath the final cover system. If groundwater extraction and ex-situ treatment is implemented (through phased approach), discharge of the treated groundwater will be to surface water or the local POTW.	Same as FDDA-3.
Availability of Necessary Equipment and Specialists	No equipment or specialists required for this alternative.	Equipment, materials and services for this alternative are readily available.	Same as FDDA-2, FDDA-4 and FDDA-5.	Same as FDDA-2, FDDA-3 and FDDA-5.	Same as FDDA-2 through FDDA-4.
Availability of Technology	Not applicable since no remedial technologies will be used.	Qualified engineers and contractors are available to design and implement this alternative.	Same as FDDA-2, FDDA-4 and FDDA-5.	Same as FDDA-2, FDDA-3 and FDDA-5.	Same as FDDA-2 through FDDA-4.
COSTS - net present value (7%) - 30 years					
Capital Costs	$0	$3,100,000	$3,400,000	$1,000,000	$4,500,000
Annual Operation, Maintenance and Monitoring	$41,000	$4,300,000 to $5,100,000	$4,100,000 to $5,700,000	$1,700,000	$5,300,000 to $7,700,000
Periodic Costs	$43,000	$130,000	$120,000	$110,000	$130,000
TOTAL	$84,000	$7,530,000 to $8,330,000	$7,620,000 to $9,220,000	$2,810,000	$9,930,000 to $12,330,000

TABLE K-3
COMPARATIVE ANALYSIS FOR DOWNGRADIENT GROUNDWATER REMEDIAL ALTERNATIVES
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

EVALUATION CRITERIA	GSA-1	GSA-2
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT		
Human Health Protection	The potential future risks will remain and RAOs will not be achieved.	The potential future risks will be eliminated and RAOs will be achieved.
Ecological Protection	The current and potential future risks will remain and RAOs will **not** be achieved.	The current and potential future risks will be eliminated and RAOs will be achieved.
COMPLIANCE WITH ARARs		
Chemical Specific	Chemical specific ARARs will **not** be met for this alternative.	This alternative will be designed and implemented to comply with the chemical specific ARARs.
Location Specific	Location specific ARARs do not apply for this alternative.	This alternative will be designed and implemented to comply with applicable location-specific ARARs.
Action Specific	Action specific ARARs do not apply for this alternative.	This alternative will be designed and implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE		
Magnitude of Residual Risk	Current and potential future exposure to contaminants in soil will continue to pose a potential residual risk.	Residual risks will be significantly reduced.
Adequacy and Reliability of Controls	No controls are proposed for this alternative.	Alternative will provide long-term effectiveness and permanence.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT		
Treatment Process Used and Materials Treated	No active treatment is proposed for this alternative.	Treatment of impacted soil is not anticipated; however, if required, ex-situ treatment of the material will be implemented.
Amount Destroyed or Treated	None	No treatment is anticipated with this alternative; however, if required, concentrations will be reduced to allow for reuse and disposal on-site beneath the landfill final cover system.
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	No reduction in toxicity, mobility or volume through treatment will be achieved with this alternative.	No active treatment of the excavated material is anticipated for this alternative; however, through re-use/disposal of the material beneath the landfill final cover system, the toxicity, mobility and volume of impacted material in the GSA is significantly reduced.
Degree to which Treatment is Irreversible	No treatment is proposed.	No treatment is anticipated.

TABLE K-3
COMPARATIVE ANALYSIS FOR DOWNGRADIENT GROUNDWATER REMEDIAL ALTERNATIVES
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

EVALUATION CRITERIA	GSA-1	GSA-2
Type and Quantity of Residuals Remaining after Treatment	Existing conditions will remain since no treatment or removal is proposed.	No active treatment of the excavated material is anticipated for this alternative; however, through excavation of the impacted material, no residuals presenting exposure risks will remain.
Degree to Which Treatment Reduces Principal Threats	No treatment is proposed.	No active treatment of the excavated material is anticipated for this alternative; however, through excavation of the impacted material, the principal threats will be eliminated.
SHORT-TERM EFFECTIVENESS		
Protection of Community During Remedial Action	Not applicable	This alternative will not have significant short-term effects on the local community.
Protection of Workers During Remedial Action	Not applicable	Use of appropriate engineering controls, PPE, and training will be incorporated into the alternative design to protect workers.
Environmental Impacts	Not applicable	Limited environmental impacts are anticipated.
Time Until Remedial Action Objectives are Achieved	RAO's will **not** be achieved through this alternative.	1 to 2 years
IMPLEMENTABILITY		
Ability to Construct and Operate the Technology	Not applicable	Common technique, straight forward to implement.
Reliability of the Technology	Not applicable	Reliable technology to quickly and effectively eliminate exposure risks.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.
Ability to Monitor Effectiveness of Remedy	Not applicable	Confirmatory soil sampling and analysis is easily implementable to measure the effectiveness of the remedy.
Ability to Obtain Approvals and Coordinate with Other Agencies	Not applicable	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.

TABLE K-3
COMPARATIVE ANALYSIS FOR DOWNGRADIENT GROUNDWATER REMEDIAL ALTERNATIVES
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

EVALUATION CRITERIA	GSA-1	GSA-2
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Not applicable	Excavated soil can be reused/disposed of on-site at one of the landfill lobes beneath the final cover system.
Availability of Necessary Equipment and Specialists	No equipment or specialists required for this alternative.	Equipment, materials and services for this alternative are readily available.
Availability of Technology	Not applicable	Qualified engineers and contractors are readily available to design and implement this alternative.
COSTS - *net present value (7%) - 30 years*		
Capital Costs	$0	$184,000
Annual Operation, Maintenance and Monitoring	$40,000	$0
Periodic Costs	$10,000	$16,000
TOTAL	**$50,000**	**$200,000**

TABLE K-4
COMPARATIVE ANALYSIS FOR DOWNGRADIENT GROUNDWATER REMEDIAL ALTERNATIVES
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

EVALUATION CRITERIA	DGGW-1	DGGW-2	DGGW-3	DGGW-4
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT				
Human Health Protection	The potential future risk of potable groundwater use **will remain** and RAOs will not be achieved.	Until the RAOs are achieved, institutional controls will be in place to prevent groundwater use/exposure, controlling human risks.	Until the RAOs are achieved, institutional controls will be in place to prevent groundwater use/exposure, controlling human risks.	Until the RAOs are achieved, institutional controls will be in place to prevent groundwater use/exposure, controlling human risks.
Ecological Protection	Not applicable	Not applicable	Not applicable	Not applicable
COMPLIANCE WITH ARARs				
Chemical Specific	Chemical specific ARARs **will not** be met.	This alternative will meet the RAOs and therefore comply with the chemical specific ARARs.	This alternative will meet the RAOs and therefore comply with the chemical specific ARARs.	This alternative will meet the RAOs and therefore comply with the chemical specific ARARs.
Location Specific	Location specific ARARs do not apply for this alternative.	This alternative can be designed and implemented to comply with applicable location specific ARARs; this alternative requires the **least amount of disruption** to the resource areas and ecological receptors during implementation.	This alternative can be designed and implemented to comply with applicable location specific ARARs; this alternative requires a **moderate to high** level of **disruption** to the resource areas and ecological receptors during construction.	This alternative can be designed and implemented to comply with applicable location specific ARARs; this alternative requires the **highest** level of **disruption** to the resource areas and ecological receptors during construction.
Action Specific	Action specific ARARs do not apply for this alternative.	This alternative can be implemented to comply with applicable action-specific ARARs.	This alternative can be implemented to comply with applicable action-specific ARARs.	This alternative can be implemented to comply with applicable action-specific ARARs.
LONG-TERM EFFECTIVENESS AND PERMANENCE				
Magnitude of Residual Risk	Potential future exposure to contaminants in groundwater **will continue** to pose a residual risk.	Until the achievement of site RAOs, implementation of institutional controls will reduce potential use and exposure to impacted groundwater; therefore residual risk is low.	Comparable to DGGW-2 and DGGW-4.	Comparable to DGGW-2 and DGGW-3.
Adequacy and Reliability of Controls	No controls are proposed.	Institutional controls should effectively limit human exposure to impacted groundwater until RAOs are achieved. Monitoring of groundwater will be required to measure the reliability of the alternative.	Institutional controls should effectively limit human exposure to impacted groundwater until RAOs are achieved. Monitoring of the extraction system's effectiveness will be required to measure the reliability of the alternative. Extraction and treatment system components will require maintenance, upkeep and potentially replacement overtime to ensure reliability over time.	Same as DGGW-3.
REDUCTION OF TOXICITY, MOBILITY AND VOLUME THROUGH TREATMENT				
Treatment Process Used and Materials Treated	No active treatment is proposed for this alternative.	Natural attenuation processes with or without enhancements, including biodegradation, dispersion, dilution, adsorption, volatilization and/or chemical and biological stabilization or destruction of contaminants, will address impacted groundwater.	A combination of ex-situ technologies such as air stripping, advanced oxidation processes and/or metals treatment, in addition to one or more pretreatment steps will treat impacted groundwater (to be determined during remedial design phase).	Same as DGGW-3.
Amount Destroyed or Treated	No active treatment is proposed for this alternative.	Natural attenuation processes are anticipated to reduce contaminants over time.	An estimated 75 gpm of groundwater will be treated through the treatment system.	Comparable to DGGW-3 (except at estimated 140 gpm).
Degree of Expected Reductions in Toxicity, Mobility or Volume through Treatment	No reduction in toxicity, mobility or volume through treatment will be achieved with this alternative.	The degree that this alternative will reduce the toxicity, mobility, and volume of COCs through natural attenuation is moderate compared to other alternatives.	Provides a high degree of reduction in toxicity and mobility and moderate degree in volume reduction.	Provides a high level of reduction in toxicity, mobility or volume through treatment.
Degree to which Treatment is Irreversible	No active treatment is proposed.	Natural degradation processes with or without enhancements will be permanent.	Ex-situ groundwater treatment will be permanent.	Ex-situ groundwater treatment will be permanent.

TABLE K-4
COMPARATIVE ANALYSIS FOR DOWNGRADIENT GROUNDWATER REMEDIAL ALTERNATIVES
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

EVALUATION CRITERIA	DGGW-1	DGGW-2	DGGW-3	DGGW-4
Type and Quantity of Residuals Remaining after Treatment	No active treatment is proposed.	No ex-situ residuals.	Low to moderate volume of treatment residuals (e.g., sludge from metals treatment) anticipated to be generated, requiring off-site disposal.	Moderate to high volume of treatment residuals (e.g., sludge from metals treatment) anticipated to be generated, requiring off-site disposal.
Degree to Which Treatment Reduces Principal Threats	No active treatment is proposed.	Upon achieving RAOs, the potential human risks to downgradient groundwater will be eliminated.	Upon treatment of contaminants in groundwater, the potential human risks to downgradient groundwater will be eliminated.	Upon treatment of contaminants in groundwater, the potential human risks to downgradient groundwater will be eliminated.
SHORT-TERM EFFECTIVENESS				
Protection of Community During Remedial Action	Not applicable since no remedial actions are included in this alternative.	No impacts to the community are anticipated for this alternative.	No significant short-term impacts to the local community are anticipated for this alternative; however, there may be a slight increase in vehicular traffic to the site during construction activities.	Similar to DGGW-3.
Protection of Workers During Remedial Action	Not applicable.	Work will be performed in accordance with applicable OSHA standards. Site-specific health and safety plan(s) will be developed to protect site workers.	Similar to DGGW-2 and DGGW-4	Similar to DGGW-2 and DGGW-3.
Environmental Impacts	Not applicable.	Impacts to the wetland resource areas are anticipated to be **limited** during activities.	Impacts to the wetland resource areas are anticipated to be **moderate to high** during construction activities due to the location of the extraction wells within the resource area.	Impacts to the wetland resource areas is anticipated to be **high** during construction activities due to the location of the extraction wells within the resource area.
Time Until Remedial Action Objectives are Achieved	RAOs will not be achieved through this alternative.	With Source Control - 67 to 79 years Without Source Control - 81 to 98 years	With Source Control - 57 to 68 years Without Source Control - 70 to 86 years	With Source Control - 40 to 49 years Without Source Control - 53 to 66 years
IMPLEMENTABILITY				
Ability to Construct and Operate the Technology	Not applicable.	No construction activities are planned for this alternative other than installation of additional monitoring wells; monitoring activities are easily implementable. If enhancements are deemed necessary, they will also be moderately implementable.	Construction in wetland resource areas will have moderate implementability.	Extensive construction in wetland resource areas may be difficult to implement.
Reliability of the Technology	Not applicable.	Site characterization data indicate that natural attenuation processes are effectively and reliably degrading contaminants.	Groundwater extraction is a demonstrated and reliable method for capturing and collecting impacted groundwater. In addition, the ex-situ treatment components are effective in treating groundwater to the remedial goals.	Similar to DGGW-3.
Ease of Undertaking Additional Remedial Actions, if necessary	This alternative will not limit or interfere with the ability to implement or perform future remedial actions.	Similar to other DGGW alternatives evaluated.	Similar to other DGGW alternatives evaluated.	Similar to other DGGW alternatives evaluated.
Ability to Monitor Effectiveness of Remedy	Not applicable.	Groundwater sampling and analysis to evaluate contaminant levels is easily implementable.	Groundwater monitoring to demonstrate hydraulic containment and to determine contaminant levels is easily implementable. Treatment system effluent will be monitored on a routine basis to evaluate the effectiveness of the treatment system and document that discharge requirements are being met.	Same as DGGW-3.

TABLE K-4
COMPARATIVE ANALYSIS FOR DOWNGRADIENT GROUNDWATER REMEDIAL ALTERNATIVES
Remedial Investigation and Feasibility Study
Sutton Brook Disposal Area Superfund Site - Tewksbury, MA

EVALUATION CRITERIA	DGGW-1	DGGW-2	DGGW-3	DGGW-4
Ability to Obtain Approvals and Coordinate with Other Agencies	Not applicable since no remedial actions are included in this alternative; therefore, no approvals or coordination required.	The remedial action will be designed and implemented under coordination with appropriate Federal and State agencies.	Similar to DGGW-2 and DGGW-4.	Similar to DGGW-2 and DGGW-3.
Availability of off-site Treatment, Storage and Disposal Services and Capacity	Not applicable.	Not applicable.	Discharge of the treated groundwater will be to surface water or the local POTW.	Discharge of the treated groundwater will be to surface water or the local POTW.
Availability of Necessary Equipment and Specialists	No equipment or specialists required for this alternative.	Equipment, materials and services for this alternative are readily available.	Similar to DGGW-2 and DGGW-4.	Similar to DGGW-2 and DGGW-3.
Availability of Technology	Not applicable since no remedial technologies will be used.	Qualified engineers and contractors are available to design and implement this alternative.	Similar to DGGW-2 and DGGW-4.	Similar to DGGW-2 and DGGW-3.
COSTS - *net present value (7%) - 30 years*				
Capital Costs	$0	$230,000	$2,900,000	$4,500,000
Annual Operation, Maintenance and Monitoring	$41,000	$1,400,000	$6,800,000 to $9,800,000	$6,500,000 to $12,200,000
Periodic Costs	$43,000	$120,000	$130,000	$130,000
TOTAL	$84,000	$1,750,000	$9,830,000 to $12,830,000	$11,130,000 to $16,830,000

DGGW-3 and DGGW-4 O&M cost range incorporates: 30 years of system operation with 30 years of groundwater monitoring - low: discharge to surface water, high: discharge to

Table L-1: Groundwater Cleanup Levels - Residential Scenario

Carcinogenic Chemical of Concern	Cancer Classification	Cleanup Level (ug/L)	Basis	RME Risk
1,1,2-Trichloroethane	C	5	MCL	3E-05
1,2-Dichloroethane	B2	5	MCL	4E-05
1,2-Dichloropropane	N/A	5	MCL	6E-06
1,4-Dichlorobenzene	N/A	75	MCL	5E-05
1,4-Dioxane	B2	4	risk	1E-06
Acrylonitrile	B1	0.05	risk	1E-06
Benzene	A	5	MCL	2E-05
Carbon Tetrachloride	B2	5	MCL	3E-05
Chloroform	B2	80	MCL	6E-04
Methylene chloride	B2	5	MCL	1E-06
Tetrachloroethene	B1	5	MCL	7E-05
Trichloroethene	N/A	5	MCL	4E-05
Vinyl Chloride	A	2	MCL	6E-05
alpha-BHC	B2	0.008	risk	1E-06
Aroclor-1254	B2	0.5	MCL	3E-06
bis(2-Ethylhexyl)phthalate	B2	6	MCL	3E-06
N-Nitrosodi-n-butylamine	B2	0.003	risk	1E-06
N-Nitrosopyrrolidine	B2	0.03	risk	1E-06
o-Toluidine	N/A	0.2	risk	8E-07
Arsenic	A	10	MCL	2E-04
Non-Carcinogenic Chemical of Concern	**Target Endpoint**	**Cleanup Level (ug/L)**	**Basis**	**RME Hazard Quotient**
1,1,1-Trichloroethane[1]	Liver	200	MCL	8E-02
1,1-Dichloroethane	CNS	360	HQ	1E+00
1,1-Dichloroethene [1]	Liver	7	MCL	5E-02
1,2-Dichloroethene (total)	Liver	100	MCL	3E+00
1,4-Dioxane	Liver	4	risk	3E-03
2-Butanone	Developmental	4000	Health Advisory	7E-01
4-Methyl-2-pentanone	Liver; Kidney	800	HQ	1E+00
Acetone	Kidney	5600	HQ	1E+00
Acrylonitrile	Reproductive	0.05	risk	1E-02
Benzene	Immune System	5	MCL	3E-01
Carbon tetrachloride	Liver	5	MCL	3E+00
cis-1,2-Dichloroethene	Blood	70	MCL	2E+00
Ethyl methacrylate	Kidney	260	HQ	1E+00
Ethylbenzene	Liver; Kidney	700	MCL	2E+00
Methylene chloride	Liver	5	MCL	9E-03
n-Propylbenzene	N/A	52	HQ	1E+00
Styrene [1]	Blood; Liver	100	MCL	2E-01
Tetrahydrofuran	N/A	227	HQ	1E+00
Toluene	Kidney	1000	MCL	2E+00
Vinyl chloride	Liver	2	MCL	9E-02
Xylenes (total)	General Toxicity	10000	MCL	1E+02
2-Methylphenol	General Toxicity; CNS	540	HQ	1E+00
3-/4-Methylphenol	General Toxicity; CNS	470	HQ	1E+00
bis(2-Ethylhexyl)phthalate	Liver	6	MCL	5E-02
Naphthalene	General Toxicity	100	Health Advisory	3E+01
Phenol	Developmental	2000	Health Advisory	6E-01
Pyridine	Liver	9	HQ	1E+00
Aroclor-1254	Immune system	0.5	MCL	2E+00
Antimony	General Toxicity	6	MCL	1E+00
Arsenic	Skin	10	MCL	3E+00
Beryllium	Gastrointestinal System	4	MCL	3E-01
Cadmium	Kidney	5	MCL	9E-01
Chromium	Gastrointestinal System	100	MCL	2E+01
Lead [1]	CNS	15	MCL	NA
Manganese	CNS	300	Health Advisory	6E-01
Selenium [1]	Liver	50	MCL	7E-01
Silver	Skin	100	Health Advisory	2E+00
Thallium	Blood	2	MCL	2E+00
Zinc	Blood	2000	Health Advisory	5E-01

Key

Health Advisory - Lifetime Health Advisory presented in EPA-822-R-04-005; Winter 2004

MCL - Maximum Contaminant Level

HQ - Hazard Quotient

NA - Not applicable

(1) This contaminant did not exceed a hazard quotient of 1 during calculations. However, the maximum detected concentration exceeded MCLs. Therefore, the cleanup level has been established as the MCL

Table L-2: Soil Cleanup Levels for the Protection of Residential Direct Contact Exposures

Group 4, Upland Soil

Carcinogenic Chemical of Concern	Cancer Classification	Cleanup Level (mg/kg)	Basis	RME Risk
Benzo(a)anthracene	N/A	4.4	risk	1E-05
Benzo(a)pyrene	B2	0.44	risk	1E-05
Benzo(b)fluoranthene	B2	4.4	risk	1E-05
Benzo(k)fluoranthene	B2	44	risk	1E-05
Dibenz(a,h)anthracene	B2	0.44	risk	1E-05
Indeno(1,2,3-cd)pyrene	B2	4.4	risk	1E-05
			Sum of Carcinogenic Risk:	6E-05

Key

Table L-3: Soil Cleanup Levels for the Protection of Ecological Receptors

Habitat Type/Name	Exposure Medium	COC	Protective Level	Units	Basis	Assessment Endpoint
Former Drum Disposal Area	Soil	1,2,4-Trimethylbenzene	1.1	mg/kg	Site-Specific NOAEL	- Sustainability (survival, growth, reproduction) of local populations of carnivorous wildlife (robin) - survival and growth of invertebrtates - abundance and diversity of plants
		1,3,5-Trimethylbenzene	1.1	mg/kg	Site-Specific NOAEL	
		bis(2-Ethylhexyl)phthalate	2.3	mg/kg	HQ = 0.1	
		Di-n-octylphthalate	0.1	mg/kg	HQ = 0.1	
		Ethylbenzene	1.1	mg/kg	Site-Specific NOAEL	
		Naphthalene	1	mg/kg	Site-Specific NOAEL	
		Toluene	1.1	mg/kg	Site-Specific NOAEL	
		Xylenes (total)	1.1	mg/kg	Site-Specific NOAEL	
Garage and Storage Area	Soil	Di-n-octylphthalate	0.4	mg/kg	HQ = 0.1	- Sustainability (survival, growth, reproduction) of local populations of carnivorous wildlife (robin) - survival and growth of invertebrtates
		Lead	65	mg/kg	HQ = 0.1	
		Zinc	190	mg/kg	Site-Specific LOAEL	

Notes:

HQ - Hazard Quotient
NOAEL - No Observable Adverse Effect Level
COC - Chemical of Concern
LOAEL - Lowest Observable Adverse Effect Level

Table L-4: Surface Water Cleanup Levels for the Protection of Ecological Receptors						
Habitat Type/Name	**Exposure Medium**	**COC**	**Protective Level**	**Units**	**Basis**	**Assessment Endpoint**
Upper Sutton Brook - Site Channel	Surface Water	4,4'-DDT	0.001	ug/L	NRWQC	- Survival and growth of potential fish and invertebrate communities
		Ethylbenzene	7.3	ug/L	Site-Specific NOAEL	
		Toluene	9.8	ug/L	Site-Specific NOAEL	
		Xylenes (total)	13	ug/L	Site-Specific NOAEL	

Notes:

NOAEL - No Observable Adverse Effect Level
COC - Chemical of Concern
NRWQC - National Recommended Water Quality Criterion

Table L-5: Sediment Cleanup Levels for the Protection of Ecological Receptors						
Habitat Type/Name	**Exposure Medium**	**COC**	**Protective Level**	**Units**	**Basis**	**Assessment Endpoint**
Upper Sutton Brook - Site Channel	Sediment	1,2,4-Trimethylbenzene	1.3	mg/kg	Site-Specific NOAEL	- Survival and growth of local populations of benthic invertebrates
		1,3,5-Trimethylbenzene	1.2	mg/kg	Site-Specific NOAEL	
		2-Methylphenol	0.1	mg/kg	Site-Specific NOAEL	
		3-/4-Methylphenol	0.6	mg/kg	Site-Specific NOAEL	
		4-Methyl-2-pentanone	0.04	mg/kg	Site-Specific NOAEL	
		Acetone	0.07	mg/kg	Site-Specific NOAEL	
		Carbon Disulfide	0.001	mg/kg	Site-Specific NOAEL	
		Chloroethane	0.03	mg/kg	Site-Specific NOAEL	
		Ethylbenzene	0.09	mg/kg	Site-Specific NOAEL	
		Toluene	0.06	mg/kg	Site-Specific NOAEL	
		Xylenes (total)	0.13	mg/kg	Site-Specific NOAEL	

Notes:

NOAEL - No Observable Adverse Effect Level
COC - Chemical of Concern

TABLE M-1
ALTERNATIVE LF-2b
CHEMICAL SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Groundwater	**Federal Regulatory Requirements**			
	Federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) (40 CFR Part 141)	Relevant and appropriate	MCLs are enforceable standards that regulate the concentration of specific organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supplies. MCLs are relevant and appropriate for the groundwater at the Site because the aquifer is a potential source of drinking water.	MCLs were used in determining groundwater preliminary remediation goals (PRGs) for site contaminants where such contaminant levels have been established. Under the LF-2b component of the selected remedy, the groundwater approach (MNA for the northern lobe; and partial containment with a vertical barrier and groundwater extraction and treatment for the southern lobe) will over time prevent groundwater exceeding MCLs from migrating beyond the point of compliance (edge of the waste management area).
	EPA Risk Reference Doses (RfDs)	To be considered	RfDs are dose levels developed by EPA for use in estimating the non-carcinogenic risk resulting from exposure to toxic substances.	RfDs were used to assess health risks due to exposure to non-carcinogenic chemicals in groundwater, and to develop of acceptable groundwater PRG concentrations. Under the LF-2b component of the selected remedy, the groundwater approach (MNA for the northern lobe; and partial containment with a vertical barrier and groundwater extraction and treatment for the southern lobe) will over time prevent groundwater exceeding PRGs from migrating beyond the point of compliance (edge of the waste management area).
	EPA Human Health Assessment Cancer Slope Factors (CSFs)	To be considered	CSFs are developed by EPA for health effects assessments or evaluation by the Human Health Assessment Group. These values present the most up-to-date cancer risk potency information and are used to compute the individual incremental cancer risk resulting from exposure to carcinogens.	CSFs were used to compute the individual cancer risk resulting from exposure to contaminants and in the development of acceptable groundwater PRG concentrations. Under the LF-2b component of the selected remedy, the groundwater approach (MNA for the northern lobe; and partial containment with a vertical barrier and groundwater extraction and treatment for the southern lobe) will over time prevent groundwater exceeding PRGs from migrating beyond the point of compliance (edge of the waste management area).
	Guidelines for Carcinogen Risk Assessment (EPA/630/P-03/001F, March 2005)	To be considered	Guidance values were used to evaluate the potential carcinogenic hazard caused by exposure to contaminants.	Cancer risks identified will be addressed by the LF-2b component of the selected remedy.
	Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA/630/R-03/003F, March 2005)	To be considered	Guidance values were used to evaluate the potential carcinogenic hazard to children caused by exposure to contaminants.	Child cancer risks identified will be addressed by the LF-2b component of the selected remedy.
	EPA Office of Water, Drinking Water Health Advisories EPA 822-R-06-013	To be considered	Health Advisories (HAs) are estimates of acceptable drinking water levels for chemical substances based on health affects information; an HA is not a legally enforceable Federal standard, but serves as technical guidance to assist federal, state and local officials. HAs were used if constituents did not have promulgated MCLs.	HAs were used to develop acceptable groundwater PRG concentrations. Under the LF-2b component of the selected remedy, the groundwater approach (MNA for the northern lobe; and partial containment with a vertical barrier and groundwater extraction and treatment for the southern lobe) will over time prevent groundwater exceeding PRGs from migrating beyond the point of compliance (edge of the waste management area).

TABLE M-1
ALTERNATIVE LF-2b
CHEMICAL SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Groundwater (Cont'd)	**State Regulatory Requirements**			
	Massachusetts Groundwater Quality Standards (314 CMR 6.00)	Applicable	These standards consist of ground water classifications, which designate and assign the uses for which the various ground waters of the Commonwealth shall be maintained and protected; water quality criteria necessary to sustain the designated uses; and regulations necessary to achieve the designated uses or maintain the existing ground water quality. The GWQSs set numeric limits for certain contaminants as well as a pH range. They were used when they were more stringent than Federal MCLs.	Groundwater beneath the Site is mapped in a potentially productive aquifer with the potential for potable water use. Under the LF-2b component of the selected remedy, the groundwater approach (MNA for the northern lobe; and partial containment with a vertical barrier and groundwater extraction and treatment for the southern lobe) will over time prevent groundwater exceeding PRGs from migrating beyond the point of compliance (edge of the waste management area).
	Massachusetts Drinking Water Standards (310 CMR 22.00)	Relevant and appropriate	These standards establish Massachusetts MCLs for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water systems. The aquifer on-site is not a public water system, but these requirements are R&A because the aquifer has the potential to be used as a source of drinking water. These requirements were used when they were more stringent than Federal MCLs.	Under the LF-2b component of the selected remedy, the groundwater approach (MNA for the northern lobe; and partial containment with a vertical barrier and groundwater extraction and treatment for the southern lobe) will over time prevent groundwater exceeding PRGs from migrating beyond the point of compliance (edge of the waste management area).
	Massachusetts DEP Office of Research and Standards Guidelines (ORSGs)	To be considered	The Massachusets DEP Office of Research and Standards issues guidance for chemicals other than those with Massachusetts MCLs in drinking water. ORSGs are concentration of chemicals in drinking water, at or below which, adverse health effects are unlikely to occur after chronic (lifetime) exposure. These guidance values were used when constituents did not have promulgated MCLs.	Under the LF-2b component of the selected remedy, the groundwater approach (MNA for the northern lobe; and partial containment with a vertical barrier and groundwater extraction and treatment for the southern lobe) will over time prevent groundwater exceeding PRGs from migrating beyond the point of compliance (edge of the waste management area).

TABLE M-2
ALTERNATIVE LF-2b
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
	Federal Regulatory Requirements			
Waste	RCRA Subtitle C - Hazardous Waste Identification and Listing Regulations (40 CFR Parts 260-262 and 40 CFR 264.13)	Applicable	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. These regulations include rules to identify hazardous waste and a requirement to obtain a detailed chemical and physical analysis of a representative sample of any hazardous wastes prior to treatment, storage, or disposal.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, this requirement was determined to be applicable. Any media generated as part of monitoring activities and groundwater extraction and treatment will be tested for hazardous waste characteristics. If determined to be hazardous waste, then they will be stored, transported, or disposed of in accordance with 40 CFR Part 264.
	RCRA Subtitle C - Closure and Post-Closure (40 CFR Subpart G, 264.111 and 264.117)	Applicable	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. 40 CFR 264.111 identifies standards for closures of hazardous wastes facilities; 40 CFR 117 identifies post-closure standards for maintenance of facilities.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, this requirement was determined to be applicable. The LF-2b component of the selected remedy will be designed and implemented to comply with this ARAR.
	RCRA Subtitle C - Landfills (40 CFR Subpart N, 264.310)	Applicable	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. These regulations establish the minimum requirements for final covers of hazardous waste landfills.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, this requirement was determined to be applicable. The LF-2b component of the selected remedy will be designed and implemented to comply with this ARAR.
	RCRA 40 CFR 264 Subpart I, Use and Management of Containers	Applicable if a container is used in the remedial action	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. This regulation establishes requirements for the storage of containers of hazardous waste.	For the groundwater portion of the LF-2b component of the selected remedy, because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, which included disposal after 1980, if a container is used to store hazardous waste, then LF-2b will be implemented to comply with this ARAR.
	RCRA 40 CFR 264 Subpart J, Tank Systems	Applicable if a tank system is used in the remedial action	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. This regulation establishes requirements for the use of tank systems for storing or treating hazardous waste.	For the groundwater portion of the LF-2b component of the selected remedy, because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, which included disposal after 1980, if a tank system is used to store hazardous waste, then LF-2b will be implemented to comply with this ARAR.
	RCRA 40 CFR 264 Subpart L, Waste Piles	Applicable if a waste pile is used in the remedial action	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. This regulation establishes requirements for the use of piles for storing or treating hazardous waste.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, which included disposal after 1980, if a pile is used to store hazardous waste (potentially such as the excavated sediments prior to consolidation into the landfill lobes), then the LF-2b component of the selected remedy will be implemented to comply with this ARAR.
	RCRA 40 CFR 264 Subpart X, Miscellaneous Units	Applicable if a miscellaneous unit is used in the remedial action	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. This regulation establishes requirements for the use of miscellaneous units for treating, storing, or disposing of hazardous waste.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, which included disposal after 1980, if a miscellaneous unit is used to store hazardous waste, then the LF-2b component of the selected remedy will be implemented to comply with this ARAR.

TABLE M-2
ALTERNATIVE LF-2b
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Waste (cont'd)	RCRA 40 CFR 264 Subpart AA, Air Emission Standards for Process Vents	Applicable if a process vent is used and if thresholds are met	This regulation establishes air emission standards for process vents, closed-vent systems, and control devices at hazardous waste facilities.	For the groundwater portion of the LF-2b component of the selected remedy, if a process vent is used in the remedial action and if applicable thresholds are met, then air emission controls will be implemented during groundwater treatment to comply with this regulation.
	RCRA 40 CFR 264 Subpart BB, Air Emission Standards for Equipment Leaks	Applicable if equipment covered by this standard is used and if thresholds are met	This regulation contains air pollutant emission standards for equipment leaks at hazardous waste TSD facilities. This subpart applies to equipment that contains or contacts hazardous wastes with organic concentrations of at least 10 percent by weight.	For the groundwater portion of the LF-2b component of the selected remedy, if equipment covered by this standard is used in the remedial action and handles hazardous wastes at concentrations that meet this rule's threshold, then a leak detection and repair program will be implemented during groundwater treatment to comply with this regulation.
	RCRA 40 CFR 264 Subpart CC, Air Emission Standards for Tanks, Surface Impoundments and Containers	Applicable if a tank or container is used and if thresholds are met	This regulation establishes air emission standards for facilities that treat, store, or dispose hazardous wastes in tanks, surface impoundments, or containers.	Any media generated as part of monitoring activities and groundwater treatment will be tested for hazardous waste characteristics. If determined to be hazardous waste, then they will be stored, transported, or disposed of in accordance with 40 CFR Part 264. If a tank or container is used in the remedial action and if applicable thresholds are met, then air emission controls will be implemented during groundwater treatment to comply with this regulation.
	RCRA 40 CFR 264 Subpart DD, Containment Buildings	Applicable if a building is used to house treatment equipment	This regulation contains design, operating, closure and post-closure standards and requirements for the storage and treatment of hazardous waste in containment buildings.	For the groundwater portion of the LF-2b component of the selected remedy, if a building is used to house treatment equipment, then the design, operation, closure, and post-closure of the treatment building for LF-2b will comply with this regulation.
	Technical Memorandum RE: Revised Alternative Cap Design Guidance Proposed for Unlined, Hazardous Waste Landfills in EPA Region 1 (February 5, 2001).	To be considered	This memo presents an alternative cover design for hazardous waste landfills capped under CERCLA within Region 1.	This TBC will be considered in the design of the final cover for the landfill lobes in meeting the RCRA Subtitle C hazardous waste landfill final cover requirements.
	Presumptive Remedy for CERCLA Municipal Landfill Sites (OSWER Directive No. 9355.0-49F)	To be considered	This guidance outlines a streamlined approach to the scoping (planning) stages of the RI/FS in the process of closing municipal landfills under CERCLA, with containment as the presumptive remedy. This directive also provides guidance regarding the appropriate level of detail appropriate for risk assessment of source areas and characterization of hot spots.	This guidance was followed in the development of the RI/FS, and the LF-2b component of the selected remedy will be designed and implemented to comply with this requirement.
	State Regulatory Requirements			
	Massachusetts Hazardous Waste Management Standards (310 CMR 30.500)	Applicable	These rules are used to identify, manage, and dispose of hazardous waste. Closure and post-closure standards are spelled out.	The LF-2b component of the selected remedy will meet all closure/post-closure standards. Any media generated as part of monitoring activities and groundwater remedial action will be tested for hazardous waste characteristics. If determined to be hazardous waste, then they will be stored, transported, or disposed of in accordance with these rules.

TABLE M-2
ALTERNATIVE LF-2b
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Waste (cont'd)	Massachusetts Technical Standards for Hazardous Waste Facilities (310 CMR 30.600, 310 CMR 30.633, 310 CMR 30.640, 310 CMR 30.660, 310 CMR 30.680, 310 CMR 30.690)	Applicable	These rules set standards for the design, performance, operation, maintenance, and monitoring of hazardous waste facilities. For hazardous waste landfills, these rules establishes performance standards for low permeability covers, post-closure care, and groundwater monitoring. These rules also prescribe requirements for the use of containers and tanks to treat or store hazardous waste.	The final landfill cover, post-closure care, and groundwater monitoring can be designed and implemented to comply with this ARAR. For the groundwater portion of the LF-2b component of the selected remedy, if containers or tank systems are used to store or treat hazardous waste, then LF-2b will be implemented to comply with this ARAR. Also, if piles are used to store hazardous waste (potentially such as the excavated sediments prior to consolidation into one of the landfill lobes), then LF-2b will be implemented to comply with this ARAR.
	MassDEP Landfill Technical Guidance, revised, May 1997	To be considered	This technical guidance outlines the closure process and design requirements for unlined landfills in Massachusetts.	This guidance was used in the remedial alternative evaluation and will be used during the landfill closure process.
Surface Water	**Federal Regulatory Requirements**			
	Clean Water Act Section 402 National Pollutant Discharge Elimination System (NPDES) (40 CFR Part 122-125 and 131)	Applicable	This act and regulations establish discharge limitations, monitoring requirements, and best management practices. Point-source discharges of effluent to surface water must comply with NPDES requirements (e.g., federal and state ambient water quality criteria (AWQC)).	On-site discharges to surface waters, including Sutton Brook and adjacent wetlands, shall meet these substantive discharge standards. These discharge limitations shall also be used to develop monitoring standards for surface waters.
	Clean Water Act (CWA) Ambient Water Quality Criteria (AWQC) (33 USC 1251 *et seq.*) (40 CFR 122.44)	Relevant and appropriate	Federal AWQC are recommended (non-enforceable) criteria published by EPA and provided to the States. AWQC are listed for protection of ecological and human health for approximately 160 contaminants. AWQC are used in establishing State water quality standards.	If treated groundwater is discharged to surface water, it will be treated as needed to comply with State water quality standards based on AWQC. Surface water monitoring will be performed. These standards will be used to help assess the effectiveness of the groundwater treatment.
	Clean Water Act (CWA) Pretreatment Regulations for Discharges to a POTW (40 CFR Part 403	Applicable if treated groundwater is discharged to the POTW	These regulations prohibit the introduction of pollutants into a publicly owned treatment works (POTW) and has pretreatment requirements for sources to a POTW	If treated groundwater is discharged to the local POTW, it will be treated as need to comply with these pretreatment requirements.
	State Regulatory Requirements			
	Mass. Clean Waters Act - MassDEP Surface Water Discharge Permit Program (314 CMR 3.00; MGL c. 21 Sections 26-53)	Applicable	This act and program establish the requirements intended to maintain the quality of surface waters by controlling the direct discharge of pollutants to surface waters. Direct discharge of wastewater to surface waters must meet effluent discharge limits established by this program.	Any on-site discharges to surface waters, including Sutton Brook and adjacent wetlands, shall meet these substantive discharge standards. These discharge limitations shall also be used to develop monitoring standards for surface waters.
	Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Applicable	The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected; which prescribe the minimum water quality criteria required to sustain the designated uses; and which contain regulations necessary to achieve the designated uses and maintain existing water quality including, where appropriate, the prohibition of discharges. These regulations limit or prohibit discharges of pollutants to surface waters to ensure that the surface water quality standards of the receiving waters are protected and maintained or attained.	Any on-site discharges to surface waters, including Sutton Brook and adjacent wetlands, shall meet these substantive discharge standards. These discharge limitations shall also be used to develop monitoring standards for surface waters.

TABLE M-2
ALTERNATIVE LF-2b
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Surface Water (Cont'd)	MassDEP Surface Water Discharge Permit Program (314 CMR 3.00)	Applicable	These regulations are intended to protect surface water bodies in the Commonwealth by regulating the discharge into them. Direct discharges of wastewater to surface waters must meet effluent discharge limits established by this program.	Any on-site discharges to surface waters, including Sutton Brook and adjacent wetlands, shall meet these substantive discharge standards. These discharge limitations shall also be used to develop monitoring standards for surface waters.
	Massachusetts Pretreatment Standards for Discharges to Wastewater Treatment Works (314 CMR 12.00)	Applicable	These regulations prohibit the introduction of pollutants into a publicly owned treatment works (POTW) and has pretreatment requirements for sources to a POTW	If treated groundwater is discharged to the local POTW, it will be treated as need to comply with these pretreatment requirements.
	MassDEP Stormwater Management Policy	To be considered	The goal of the policy is to improve water quality and address water quantity problems within Massachusetts through the implementation of performance standards for stormwater management.	The LF-2b component of the selected remedy will be designed and implemented to comply with this requirement.
Groundwater	**Federal Regulatory Requirements**			
	RCRA Subtitle C - Releases from Solid Waste Management Units (40 CFR Subpart F, 264.95 and 264.96(a) and (c))	Applicable	These regulations identify specific monitoring requirements applicable to hazardous waste facilities, including specifying the point of compliance at which the groundwater protection standards apply and at which monitoring must be conducted, as well as specifying the compliance period during which the groundwater protection standard applies.	The LF-2b component of the selected remedy will be implemented to comply with these requirements. EPA has determined that the point of compliance at which the groundwater protection standards apply is the edge of the waste management unit (the landfill lobes).
	Underground Injection (40 CFR Part 144)	Relevant and appropriate	These regulations provide regulatory compliance standards for treatment facilities that inject wastes underground. The use at wells to dispose of hazardous waste is prohibited.	If the performance of the LF-2b component of the selected remedy utilizes underground injection for the treated groundwater or uses an infiltration gallery or any other system that disposes of treatment water or waste into groundwater as the remediation technology, groundwater will be treated to be non-hazardous prior to subsurface discharge.
	Final OSWER Directive "Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites (OSWER Dir. 9200.4-17P, 4/12/99)	To be considered	This guidance sets criteria for evaluating monitored natural attenuation as a remedy at, among others, Superfund sites.	For Northern Lobe portion of the LF-2b component of the selected remedy, monitored natural attenuation was determined to be appropriate in accordance with this TBC. Under LB-2b, for the Northern Plume groundwater, contaminant levels at the point of compliance (at the edge of the waste management unit) will be monitored consistent with this guidance.
	State Regulatory Requirements			
	MassDEP Underground Injection Control Regulations (310 CMR 27.00)	Applicable	These regulations are intended to protect underground sources of drinking water by regulating the underground injection of hazardous wastes, fluids used for extraction of minerals, oil, and energy, and any other fluids having potential to contaminate groundwater.	If the performance of the LF-2b component of the selected remedy utilizes underground injection for the treated groundwater or uses an infiltration gallery or any other system that disposes of treatment water or waste into groundwater as the remediation technology, groundwater will be treated to be non-hazardous prior to subsurface discharge.
	MassDEP Groundwater Discharge Permit Program (314 CMR 5.00)	Applicable	These regulations are intended to protect groundwater quality by controlling the discharge of pollutants to the ground waters of the Commonwealth to assure that these waters are protected for their highest potential use. These regulations set effluent limits for the discharge of pollutants to groundwater.	If the performance of the LF-2b component of the selected remedy utilizes underground injection, infiltration gallery or any other system that disposes of treatment water or waste into groundwater as the remediation technology, groundwater will be treated to meet the substantive requirements of these regulations prior to subsurface discharge.
	Massachusetts Well Decommissioning Requirements (313 CMR 3.03)	Applicable	These regulations provide for certain notification requirements upon well abandonment.	These regulations will be followed to the extent that the alternative involves decommissioning any wells.

TABLE M-2
ALTERNATIVE LF-2b
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Soils/Sediments	**State Regulatory Requirements**			
	Reuse and Disposal of Contaminated Soils at Massachusetts Landfills (COMM-97-001)	To be considered	This Policy provides information about the Massachusetts Department of Environmental Protection's requirements, standards, management practices and approvals for the testing, tracking, transport, and reuse or disposal of Contaminated Soil at Massachusetts landfills.	The LF-2b component of the selected remedy will be designed and implemented to comply with this policy.
Air	**Federal Regulatory Requirements**			
	Clean Air Act National Emissions Standards for Hazardous Air Pollutants (NESHAPs), 40 CFR Part 61	Applicable	These regulations set standards for emissions of 189 Hazardous Air Pollutants that are listed in Section 112(b)(1) of the Clean Air Act.	For the groundwater portion of the LF-2b component of the selected remedy, if air stripping is used and any of the 189 hazardous air pollutants are emitted, then LF-2b will comply with this ARAR.
	OSWER Directive 9355.0-28, Air Stripper Control Guidance, 7/12/89	To be considered	This OSWER directive establishes guidance on the control of air emissions from air strippers used at Superfund sites for groundwater treatment.	For the groundwater portion of the LF-2b component of the selected remedy, if air stripping is used, then LF-2b will comply with this policy.
	State Regulatory Requirements			
	Massachusetts Ambient Air Quality Standards (310 CMR 6.00)	Applicable	These regulations set primary and secondary standards for emissions of sulfur oxides, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead.	For the groundwater portion of the LF-2b component of the selected remedy, if air stripping is used, then LF-2b will comply with this policy. No air emissions from remedial treatment will cause ambient air quality standards to be exceeded.
	MassDEP Revised Ambient Air Guidelines (December 6, 1995)	To be considered	This document presents MassDEP's revised ambient air guidelines, presenting the Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs).	The LF-2b component of the selected remedy will be designed and implemented to comply with this policy.
	Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Applicable	This regulation stipulates that during construction and/or demolition activities, air emissions (i.e. dust, particulates, etc.) must be controlled to prevent air pollution.	Construction activities will be managed to meet the standards for visible emissions (310 CMR 7.06); dust, odor, construction, and demolition (310 CMR 7.09); and noise (310 CMR 7.10). If air stripping is used, then the groundwater portion of the LF-2b component of the selected remedy will comply with this ARAR. Odor emissions from the groundwater treatment air stripper will be controlled with best available control technology.

TABLE M-3
ALTERNATIVE LF-2b
LOCATION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Location	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Surface Water, Wetlands, Floodplains	**Federal Regulatory Requirements and Guidance**			
	Wetlands Executive Order (EO11990), 40 CFR 6.302(a), and 40 CFR Part 6, Appendix A	Applicable	The Wetlands Executive Order requires federal agencies to avoid undertaking or providing assistance for new construction located in wetlands unless there is no practicable alternative and the proposed action includes all practicable measures to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands.	Under the LF-2b component of the selected remedy, the installation of the landfill cover, the construction of a vertical barrier along a portion of the Southern Lobe, and the installation of wells and treatment plant for the Southern Lobe groundwater will result in the unavoidable destruction of existing wetlands. During remedial design the effects of remedial activities on the wetlands will be evaluated and minimized. Compensatory wetlands mitigation will be performed as necessary to comply with this ARAR.
	Clean Water Act Section 404 Dredge and Fill Regulations (40 CFR 230, 33 CFR 320-323)	Applicable	These regulations outline the requirements for the discharge of dredged or fill materials into surface waters including wetlands. No activity that impacts waters of the United States shall be permitted if a practicable alternative that has less adverse impact on the aquatic ecosystem exists. If there is no other practicable alternative, the impacts must be mitigated.	Under the LF-2b component of the selected remedy, the installation of the landfill cover, the construction of a vertical barrier along a portion of the Southern Lobe, and the installation of wells and treatment plant for the Southern Lobe groundwater will result in the unavoidable destruction of existing wetlands. During remedial design the effects of remedial activities on the wetlands will be evaluated and avoided and/or minimized. Compensatory wetlands mitigation will be performed as necessary to comply with this ARAR. In addition, brook sediment excavation would be unavoidable in order to remediate contaminated sediments. Under the LF-2b component of the selected remedy, the brook sediments will be restored with clean sediments. Alternative LF-2b is the least environmentally damaging practicable alternative that meets the remedial action objectives.
	Floodplains Executive Order (EO11988), 40 CFR 6.302(b), and 40 CFR Part 6, Appendix A	Applicable	The Floodplains Executive Order requires federal agencies to avoid impacts associated with the occupancy and modification of a floodplain unless there is no practicable alternative and the proposed action includes all practicable measure to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the natural and beneficial values of floodplains.	Under the LF-2b component of the selected remedy, available practicable means will be used to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the floodplains. In areas where the landfill cover, vertical barrier, wells and treatment plant will result in the filling in of areas within the 100-year floodplain, there will be a replication of 100-year floodplain space equivalent to the amount loss. Stormwater management basins will be designed to minimize the impact of floods.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate	These regulations require that a hazardous waste facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout by a 100-year storm.	Under the LF-2b component of the selected remedy, available practicable means will be used to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the floodplains. In areas where the landfill cover, vertical barrier, wells and treatment plant will result in the filling in of areas within the 100-year floodplain, there will be a replication of 100-year floodplain space equivalent to the amount loss. Stormwater management basins will be designed to minimize the impact of floods. The landfill cover and any structures will be designed to withstand the effects of a 100-year storm.
	Fish and Wildlife Coordination Act (16 USC 661 et seq, 40 CFR Part 6)	Applicable	The Fish and Wildlife Coordination Act requires action to protect fish and wildlife and requires consultation with the U.S. Fish and Wildlife Service and state wildlife agencies to mitigate losses of fish and wildlife that result from modification of a water body.	Since the LF-2b component of the selected remedy requires modification of a water body, when the sediments in Sutton Brook between the two landfill lobes are excavated, this consultation requirement will be conducted.

TABLE M-3
ALTERNATIVE LF-2b
LOCATION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Location	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
	State Regulatory Requirements			
Surface Water, Wetlands, Floodplains (Cont'd)	Massachusetts Wetlands Regulations (310 CMR 10.00; MGL c. 131, Section 40: Wetlands Protection Act)	Applicable	These regulations set performance standards for dredging, filling, and altering of any inland wetland, the buffer zone within 100 feet of a wetland, and the riverfront area (defined as the area between the river's mean annual high-water line and a line located 200 feet away). The requirement also defines wetlands based on vegetation type and requires that effects on wetlands be mitigated. Resource areas at the Site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, riverfront and estimated habitats of rare wildlife. Under this requirement, available alternatives must be considered that minimize the extent of adverse impacts, and mitigation including restoration and/or replication is required.	The installation of the landfill cover, the construction of a vertical barrier along a portion of the Southern Lobe, and the installation of wells and treatment plant for the Southern Lobe groundwater will occur in or around wetlands (and their 100 foot buffer zones) and Sutton Brook (and its riverfront area). Sediments in Sutton Brook will be excavated and restored with clean sediments. Because of the contamination in the landfill source areas, there is no practicable alternative to installing an impermeable cap and the other portions of LF-2b. All practicable means will be used to avoid or minimize harm to the wetlands, including erosion and sedimentation controls and stormwater management. Wetlands and sediments unavoidably disturbed by remedial activities will be mitigated, restored or preserved.
	Massachusetts Water Quality Certification for Discharge of Dredged or Fill Material, Dredging, and Dredging Material Disposal in Waters of the U.S. within the Commonwealth (314 CMR 9.00)	Applicable	For discharges of dredged or fill material: there must be no practicable alternative with less adverse impact on the aquatic ecosystem; appropriate and practicable steps must be taken to avoid and minimize potential adverse impacts to wetlands and land under water; stormwater discharges must be controlled with BMPs; and there must not be substantial adverse impacts to the physical, chemical, or biological integrity of surface waters. For dredging and dredged material management: there must be no practicable alternative with less adverse impact on the aquatic ecosystem; and if avoidance is not possible then minimize, or if neither avoidance or minimization are possible, then mitigate potential adverse impacts.	The installation of the landfill cover, the construction of a vertical barrier along a portion of the Southern Lobe, and the installation of wells and treatment plant for the Southern Lobe groundwater will occur in or around wetlands (and their 100 foot buffer zones) and Sutton Brook (and its riverfront area). Sediments in Sutton Brook will be excavated and restored with clean sediments. Because of the contamination in the landfill source areas, there is no practicable alternative to installing an impermeable cap and the other portions of LF-2b. All practicable means will be used to avoid or minimize harm to the wetlands, including erosion and sedimentation controls and stormwater management. Wetlands and sediments unavoidably disturbed by remedial activities will be mitigated, restored or preserved. There would be no substantial long-term adverse impacts to the integrity of surface waters.
	Massachusetts Waterways Regulations (310 CMR 9.00)	Applicable	These regulations set forth criteria for work within flowed and filled tidelands and other waterways. Waterways concerns focus on the long term viability of marine uses and protecting public rights in tidelands, including fishing and access.	Under the LF-2b component of the selected remedy, actions within waterways at the Site will comply with the regulation's environmental standards.
	Massachusetts Hazardous Waste Rules, Facility Location Standards (310 CMR 30.700)	Applicable	These regulations set forth criteria for siting hazardous waste facilities within Land Subject to Flooding (as defined under the Massachusetts Wetlands Protection standards); surface water supplies; and actual, planned, or potential public water supplies	Under the LF-2b component of the selected remedy, any remedial structures, including the landfills, within Land Subject to Flooding and potential public water supply area, will be designed, constructed, operated, and maintained to prevent a release of hazardous waste within the protected resource area.

TABLE M-3
ALTERNATIVE LF-2b
LOCATION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Location	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Other Natural Resources	**Federal Regulatory Requirements**			
	Endangered Species Act (16 USC 1531 et seq.; 40 CFR 6.302(h); 50 CFR 402)	Applicable if encountered	This statute requires that Federal agencies avoid activities which jeopardize threatened or endangered species or adversely modify habitats essential to their survival. Mitigation measures should be considered if a listed species or habitat may be jeopardized.	No endangered or threatened species have been identified at the Site to date. If endangered or threatened species in the site area are identified, remedial activities would avoid actions that would adversely affect threatened or endangered species or habitats.
	National Historic Preservation Act (16 USC 470 et seq., 36 CFR 800)	Applicable if encountered	Pursuant to Sections 106 and 110(f) of the NHPA, as amended, CERCLA response actions are required to take into account the effects of the response activities on any historic property included or eligible for inclusion on the National Register of Historic Places.	Should the LF-2b component of the selected remedy impact historic properties, as determined in the remedial design, activities will be coordinated with the Massachusetts Historical Commission (MHC). If it is determined that adverse impacts are unavoidable, then MHC will be consulted to determine ways to minimize and/or mitigate such adverse impacts.
	State Regulatory Requirements			
	Antiquities Act and Regulations; Massachusetts Historical Commission; Protection of Properties Included in the State Register of Historic Places (M.G.L. ch. 9, sec. 26-27; 950 CMR 70.00)	Applicable if encountered	These regulations require the adoption of all prudent and feasible means to eliminate, minimize or mitigate adverse effects to historic or archaeological properties, and require coordination with the Massachusetts Historical Commission.	Should the LF-2b component of the selected remedy impact historic or archaeological properties, as determined in the remedial design, activities will be coordinated with the Massachusetts Historical Commission (MHC). If it is determined that adverse impacts cannot be eliminated, then MHC will be consulted to determine ways to minimize and/or mitigate such adverse impacts.
	Massachusetts Endangered Species Act, 321 CMR 10.00, (MGL c. 131A)	Applicable if encountered	The Commonwealth of Massachusetts has the authority to research, list, and protect any species deemed endangered, threatened, or of other special concern. These species are listed as either endangered, threatened, or species of special concern in the regulations. Actions must be conducted in a manner that minimizes the effect on Massachusetts-listed endangered species and species listed by the Massachusetts Natural Heritage Program.	No endangered or threatened species have been identified at the Site to date. If endangered or threatened species in the site area are identified, remedial activities would avoid actions that would adversely affect threatened or endangered species or habitats.

TABLE M-4
ALTERNATIVE FDDA-4
CHEMICAL SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Groundwater	**Federal Regulatory Requirements**			
	Federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) (40 CFR Part 141)	Relevant and appropriate	MCLs are enforceable standards that regulate the concentration of specific organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supplies. MCLs are relevant and appropriate for the groundwater at the Site because the aquifer is a potential source of drinking water.	MCLs were used in determining groundwater preliminary remediation goals (PRGs) for site contaminants where such contaminant levels have been established. Under the FDDA-4 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the FDDA achieving PRGs.
	EPA Risk Reference Doses (RfDs)	To be considered	RfDs are dose levels developed by EPA for use in estimating the non-carcinogenic risk resulting from exposure to toxic substances.	RfDs were used to assess health risks due to exposure to non-carcinogenic chemicals in groundwater, and to develop of acceptable groundwater PRG concentrations. Under the FDDA-4 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the FDDA achieving PRGs.
	EPA Human Health Assessment Cancer Slope Factors (CSFs)	To be considered	CSFs are developed by EPA for health effects assessments or evaluation by the Human Health Assessment Group. These values present the most up-to-date cancer risk potency information and are used to compute the individual incremental cancer risk resulting from exposure to carcinogens.	CSFs were used to compute the individual cancer risk resulting from exposure to contaminants in groundwater, and in the development of acceptable groundwater PRG concentrations. Under the FDDA-4 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the FDDA achieving PRGs.
	Guidelines for Carcinogen Risk Assessment (EPA/630/P-03/001F, March 2005)	To be considered	Guidance values were used to evaluate the potential carcinogenic hazard caused by exposure to contaminants.	Cancer risks identified will be addressed by the FDDA-4 component of the selected remedy.
	Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA/630/R-03/003F, March 2005)	To be considered	Guidance values were used to evaluate the potential carcinogenic hazard to children caused by exposure to contaminants.	Child cancer risks identified will be addressed by the FDDA-4 component of the selected remedy.
	EPA Office of Water, Drinking Water Health Advisories EPA 822-R-06-013	To be considered	Health Advisories (HAs) are estimates of acceptable drinking water levels for chemical substances based on health affects information; an HA is not a legally enforceable Federal standard, but serves as technical guidance to assist federal, state and local officials. HAs were used if constituents did not have promulgated MCLs.	HAs were used to develop acceptable groundwater PRG concentrations. Under the FDDA-4 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the FDDA achieving PRGs.
	State Regulatory Requirements			
	Massachusetts Groundwater Quality Standards (314 CMR 6.00)	Applicable	These standards consist of ground water classifications, which designate and assign the uses for which the various ground waters of the Commonwealth shall be maintained and protected; water quality criteria necessary to sustain the designated uses; and regulations necessary to achieve the designated uses or maintain the existing ground water quality. The GWQSs set numeric limits for certain contaminants as well as a pH range. They were used when they were more stringent than Federal MCLs.	Groundwater beneath the Site is mapped in a potentially productive aquifer with the potential for potable water use. Under the FDDA-4 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the FDDA achieving PRGs.

TABLE M-4
ALTERNATIVE FDDA-4
CHEMICAL SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Groundwater (Cont'd)	Massachusetts Drinking Water Standards (310 CMR 22.00)	Relevant and appropriate	These standards establish Massachusetts MCLs for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water systems. The aquifer on-site is not a public water system, but these requirements are R&A because the aquifer has the potential to be used as a source of drinking water. These requirements were used when they were more stringent than Federal MCLs.	Under the FDDA-4 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the FDDA achieving PRGs.
	Massachusetts DEP Office of Research and Standards Guidelines (ORSGs)	To be considered	The Massachusets DEP Office of Research and Standards issues guidance for chemicals other than those with Massachusetts MCLs in drinking water. ORSGs are concentration of chemicals in drinking water, at or below which, adverse health effects are unlikely to occur after chronic (lifetime) exposure. These guidance values were used when constituents did not have promulgated MCLs.	Under the FDDA-4 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the FDDA achieving PRGs.
Soils	**Federal Regulatory Requirements**			
	EPA Risk Reference Doses (RfDs)	To be considered	RfDs are dose levels developed by EPA for use in estimating the non-carcinogenic risk resulting from exposure to toxic substances.	RfDs were used to assess health risks due to exposure to non-carcinogenic chemicals in soils, and to develop soil cleanup levels. Under the FDDA-4 component of the selected remedy, soils with concentrations above the soil cleanup levels will be excavated to be consolidated with the wastes in the Landfill Lobes prior to capping.
	EPA Human Health Assessment Cancer Slope Factors (CSFs)	To be considered	CSFs are developed by EPA for health effects assessments or evaluation by the Human Health Assessment Group. These values present the most up-to-date cancer risk potency information and are used to compute the individual incremental cancer risk resulting from exposure to	CSFs were used to compute the individual cancer risk resulting from exposure to contaminants in soils, and in the development of soil cleanup levels. Under the FDDA-4 component of the selected remedy, soils with concentrations above the soil cleanup levels will be excavated to be

TABLE M-5
ALTERNATIVE FDDA-4
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Waste	**Federal Regulatory Requirements**			
	RCRA Subtitle C - Hazardous Waste Identification and Listing Regulations (40 CFR Parts 260-262 and 40 CFR 264.13)	Applicable	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. These regulations include rules to identify hazardous waste and a requirement to obtain a detailed chemical and physical analysis of a representative sample of any hazardous wastes prior to treatment, storage, or disposal.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, this requirement was determined to be applicable. Any media generated as part of monitoring activities and groundwater extraction and treatment will be tested for hazardous waste characteristics. If determined to be hazardous waste, then they will be stored, transported, or disposed of in accordance with 40 CFR Part 264.
	RCRA 40 CFR 264 Subpart I, Use and Management of Containers	Applicable if a container is used in the remedial action	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. This regulation establishes requirements for the storage of containers of hazardous waste.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, if the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if a container is used to store hazardous waste, then FDDA-4 will be implemented to comply with this ARAR.
	RCRA 40 CFR 264 Subpart J, Tank Systems	Applicable if a tank system is used in the remedial action	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. This regulation establishes requirements for the use of tank systems for storing or treating hazardous waste.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, if the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if a tank system is used to store hazardous waste, then FDDA-4 will be implemented to comply with this ARAR.
	RCRA 40 CFR 264 Subpart L, Waste Piles	Applicable if a waste pile is used in the remedial action	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. This regulation establishes requirements for the use of piles for storing or treating hazardous waste.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, if piles are used to store hazardous waste (potentially such as the excavated contaminated soils in FDDA prior to consolidation into the landfill lobes), then the FDDA-4 component of the selected remedy can be implemented to comply with this ARAR.
	RCRA 40 CFR 264 Subpart X, Miscellaneous Units	Applicable if a miscellaneous unit is used in the remedial action	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. This regulation establishes requirements for the use of miscellaneous units for treating, storing, or disposing of hazardous waste.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, if the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if a miscellaneous unit is used to store hazardous waste, then FDDA-4 will be implemented to comply with this ARAR.
	RCRA 40 CFR 264 Subpart AA, Air Emission Standards for Process Vents	Applicable if a process vent is used and if thresholds are met	This regulation establishes air emission standards for process vents, closed-vent systems, and control devices at hazardous waste facilities.	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy, if a process vent is used in the remedial action and if applicable thresholds are met, then air emission controls will be implemented during groundwater treatment to comply with this regulation.

TABLE M-5
ALTERNATIVE FDDA-4
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Waste (cont'd)	RCRA 40 CFR 264 Subpart BB, Air Emission Standards for Equipment Leaks	Applicable if equipment covered by this standard is used and if thresholds are met	This regulation contains air pollutant emission standards for equipment leaks at hazardous waste TSD facilities. This subpart applies to equipment that contains or contacts hazardous wastes with organic concentrations of at least 10 percent by weight.	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if equipment covered by this standard is used in the remedial action and handles hazardous wastes at concentrations that meet this rule's threshold, then a leak detection and repair program will be implemented during groundwater treatment to comply with this regulation.
	RCRA 40 CFR 264 Subpart CC, Air Emission Standards for Tanks, Surface Impoundments and Containers	Applicable if a tank or container is used and if thresholds are met	This regulation establishes air emission standards for facilities that treat, store, or dispose hazardous wastes in tanks, surface impoundments, or containers.	Any media generated as part of monitoring activities and groundwater treatment (if the contingency is needed) will be tested for hazardous waste characteristics. If determined to be hazardous waste, then they will be stored, transported, or disposed of in accordance with 40 CFR Part 264. If a tank or container is used in the remedial action and if applicable thresholds are met, then air emission controls will be implemented during groundwater treatment to comply with this regulation.
	RCRA 40 CFR 264 Subpart DD, Containment Buildings	Applicable if a building is used to house treatment equipment	This regulation contains design, operating, closure and post-closure standards and requirements for the storage and treatment of hazardous waste in containment buildings.	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if a building is used to house treatment equipment, then the design, operation, closure, and post-closure of the treatment building for FDDA-4 will comply with this regulation.
Surface Water	**Federal Regulatory Requirements**			
	Clean Water Act Section 402 National Pollutant Discharge Elimination System (NPDES) (40 CFR Part 122-125 and 131)	Applicable	This act and regulations establish discharge limitations, monitoring requirements, and best management practices. Point-source discharges of effluent to surface water must comply with NPDES requirements (e.g., federal and state ambient water quality criteria (AWQC)).	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy, on-site discharges to surface waters, including Sutton Brook and adjacent wetlands, shall meet these substantive discharge standards. These discharge limitations shall also be used to develop monitoring standards for surface waters.
	Clean Water Act (CWA) Ambient Water Quality Criteria (AWQC) (33 USC 1251 *et seq.*) (40 CFR 122.44)	Relevant and appropriate	Federal AWQC are recommended (non-enforceable) criteria published by EPA and provided to the States. AWQC are listed for protection of ecological and human health for approximately 160 contaminants. AWQC are used in establishing State water quality standards.	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if treated groundwater is discharged to surface water, it will be treated as needed to comply with State water quality standards based on AWQC. Surface water monitoring will be performed. These standards will be used to help assess the effectiveness of the groundwater treatment.
	Clean Water Act (CWA) Pretreatment Regulations for Discharges to a POTW (40 CFR Part 403	Applicable if treated groundwater is discharged to the POTW	These regulations prohibit the introduction of pollutants into a publicly owned treatment works (POTW) and has pretreatment requirements for sources to a POTW	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if treated groundwater is discharged to the local POTW, it will be treated as need to comply with these pretreatment requirements.
	State Regulatory Requirements			
	Mass. Clean Waters Act - MassDEP Surface Water Discharge Permit Program (314 CMR 3.00; MGL c. 21 Sections 26-53)	Applicable	This act and program establish the requirements intended to maintain the quality of surface waters by controlling the direct discharge of pollutants to surface waters. Direct discharge of wastewater to surface waters must meet effluent discharge limits established by this program.	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy, on-site discharges to surface waters, including Sutton Brook and adjacent wetlands, shall meet these substantive discharge standards. These discharge limitations shall also be used to develop monitoring standards for surface waters.

TABLE M-5
ALTERNATIVE FDDA-4
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Surface Water (Cont'd)	Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Applicable	The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected; which prescribe the minimum water quality criteria required to sustain the designated uses; and which contain regulations necessary to achieve the designated uses and maintain existing water quality including, where appropriate, the prohibition of discharges. These regulations limit or prohibit discharges of pollutants to surface waters to ensure that the surface water quality standards of the receiving waters are protected and maintained or attained.	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy, on-site discharges to surface waters, including Sutton Brook and adjacent wetlands, shall meet these substantive discharge standards. These discharge limitations shall also be used to develop monitoring standards for surface waters.
	MassDEP Surface Water Discharge Permit Program (314 CMR 3.00)	Applicable	These regulations are intended to protect surface water bodies in the Commonwealth by regulating the discharge into them. Direct discharges of wastewater to surface waters must meet effluent discharge limits established by this program.	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy, on-site discharges to surface waters, including Sutton Brook and adjacent wetlands, shall meet these substantive discharge standards. These discharge limitations shall also be used to develop monitoring standards for surface waters.
	Massachusetts Pretreatment Standards for Discharges to Wastewater Treatment Works (314 CMR 12.00)	Applicable	These regulations prohibit the introduction of pollutants into a publicly owned treatment works (POTW) and has pretreatment requirements for sources to a POTW	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if treated groundwater is discharged to the local POTW, it will be treated as need to comply with these pretreatment requirements.
	MassDEP Stormwater Management Policy	To be considered	The goal of the policy is to improve water quality and address water quantity problems within Massachusetts through the implementation of performance standards for stormwater management.	The FDDA-4 component of the selected remedy will be designed and implemented to comply with this requirement.
Groundwater	**Federal Regulatory Requirements**			
	RCRA Subtitle C - Releases from Solid Waste Management Units (40 CFR Subpart F, 264.95 and 264.96(a) and (c))	Applicable	These regulations identify specific monitoring requirements applicable to hazardous waste facilities, including specifying the point of compliance at which the groundwater protection standards apply and at which monitoring must be conducted, as well as specifying the compliance period during which the groundwater protection standard applies.	The FDDA-4 component of the selected remedy will be implemented to comply with these requirements. Because EPA has determined that the point of compliance at which the groundwater protection standards apply is the edge of the waste management unit (the landfill lobes), these standards will be met throughout the FDDA.
	Underground Injection (40 CFR Part 144)	Relevant and appropriate	These regulations provide regulatory compliance standards for treatment facilities that inject wastes underground. The use at wells to dispose of hazardous waste is prohibited.	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if the performance of the FDDA-4 component of the selected remedy utilizes underground injection for the treated groundwater or uses an infiltration gallery or any other system that disposes of treatment water or waste into groundwater as the remediation technology, groundwater will be treated to be non-hazardous prior to subsurface discharge.

TABLE M-6
ALTERNATIVE FDDA-4
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Groundwater (Cont'd)	Final OSWER Directive "Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites (OSWER Dir. 9200.4-17P, 4/12/99)	To be considered	This guidance sets criteria for evaluating monitored natural attenuation as a remedy at, among others, Superfund sites.	For the FDDA-4 component of the selected remedy, monitored natural attenuation was determined to be appropriate in accordance with this TBC. Under FDDA-4, contaminant levels in the groundwater plume underneath FDDA will be monitored consistent with this guidance. Active groundwater treatment is retained as a contingency if determined to be necessary as described in Part 2 of the ROD.
	State Regulatory Requirements			
	MassDEP Underground Injection Control Regulations (310 CMR 27.00)	Applicable	These regulations are intended to protect underground sources of drinking water by regulating the underground injection of hazardous wastes, fluids used for extraction of minerals, oil, and energy, and any other fluids having potential to contaminate groundwater.	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if the performance of the FDDA-4 component of the selected remedy utilizes underground injection for the treated groundwater or uses an infiltration gallery or any other system that disposes of treatment water or waste into groundwater as the remediation technology, groundwater will be treated to be non-hazardous prior to subsurface discharge.
	MassDEP Groundwater Discharge Permit Program (314 CMR 5.00)	Applicable	These regulations are intended to protect groundwater quality by controlling the discharge of pollutants to the ground waters of the Commonwealth to assure that these waters are protected for their highest potential use. These regulations set effluent limits for the discharge of pollutants to groundwater.	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if this contingent remedy utilizes underground injection, infiltration gallery or any other system that disposes of treatment water or waste into groundwater as the remediation technology, groundwater will be treated to meet the substantive requirements of these regulations prior to subsurface discharge.
	Massachusetts Well Decommissioning Requirements (313 CMR 3.03)	Applicable	These regulations provide for certain notification requirements upon well abandonment.	These regulations will be followed to the extent that the alternative involves decommissioning any wells.
Air	**Federal Regulatory Requirements**			
	Clean Air Act National Emissions Standards for Hazardous Air Pollutants (NESHAPs), 40 CFR Part 61	Applicable	These regulations set standards for emissions of 189 Hazardous Air Pollutants that are listed in Section 112(b)(1) of the Clean Air Act.	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if air stripping is used and any of the 189 hazardous air pollutants are emitted, then FDDA-4 will comply with this ARAR.
	OSWER Directive 9355.0-28, Air Stripper Control Guidance, 7/12/89	To be considered	This OSWER directive establishes guidance on the control of air emissions from air strippers used at Superfund sites for groundwater treatment.	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if air stripping is used, then FDDA-4 will comply with this policy.
	State Regulatory Requirements			
	Massachusetts Ambient Air Quality Standards (310 CMR 6.00)	Applicable	These regulations set primary and secondary standards for emissions of sulfur oxides, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead.	If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if air stripping is used, then FDDA-4 will comply with this policy. No air emissions from remedial treatment will cause ambient air quality standards to be exceeded.

TABLE M-5
ALTERNATIVE FDDA-4
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Air (Cont'd)	MassDEP Revised Ambient Air Guidelines (December 6, 1995)	To be considered	This document presents MassDEP's revised ambient air guidelines, presenting the Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs).	The FDDA-4 component of the selected remedy will be designed and implemented to comply with this policy.
	Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Applicable	This regulation stipulates that during construction and/or demolition activities, air emissions (i.e. dust, particulates, etc.) must be controlled to prevent air pollution.	Construction activities will be managed to meet the standards for visible emissions (310 CMR 7.06); dust, odor, construction, and demolition (310 CMR 7.09); and noise (310 CMR 7.10). If the active groundwater treatment contingency is needed for the FDDA-4 component of the selected remedy and if air stripping is used, then FDDA-4 will comply with this ARAR. Odor emissions from the groundwater treatment air stripper will be controlled with best available control technology.

TABLE M-6
ALTERNATIVE FDDA-4
LOCATION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Location	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
	Federal Regulatory Requirements and Guidance			
Surface Water, Wetlands, Floodplains	Wetlands Executive Order (EO11990), 40 CFR 6.302(a), and 40 CFR Part 6, Appendix A	Applicable	The Wetlands Executive Order requires federal agencies to avoid undertaking or providing assistance for new construction located in wetlands unless there is no practicable alternative and the proposed action includes all practicable measures to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands.	Under the FDDA-4 component of the selected remedy, the excavation of contaminated soil areas and the installation of wells and possible treatment plant (if the active groundwater treatment contingency is needed) will occur close to delineated wetland boundaries and potentially may disturb some areas. Because of the contamination in soils in the FDDA, there is no practicable alternative to the excavation of these contaminated soils for consolidation with the Landfill Lobes prior to capping. Similarly, if the active groundwater treatment contingency is needed, wetlands may be unavoidably impacted. During remedial design, the effects of remedial activities on the wetlands will be evaluated and minimized. Compensatory wetlands mitigation would be performed as necessary to comply with this ARAR.
	Clean Water Act Section 404 Dredge and Fill Regulations (40 CFR 230, 33 CFR 320-323)	Applicable	These regulations outline the requirements for the discharge of dredged or fill materials into surface waters including wetlands. No activity that impacts waters of the United States shall be permitted if a practicable alternative that has less adverse impact on the aquatic ecosystem exists. If there is no other practicable alternative, the impacts must be mitigated.	Under the FDDA-4 component of the selected remedy, the excavation of contaminated soil areas and the installation of wells and possible treatment plant (if the active groundwater treatment contingency is needed) will occur close to delineated wetland boundaries and potentially may disturb some areas. Because of the contamination in soils in the FDDA, there is no practicable alternative to the excavation of these contaminated soils for consolidation with the Landfill Lobes prior to capping. Similarly, if the active groundwater treatment contingency is needed, wetlands may be unavoidably impacted. During remedial design, the effects of remedial activities on the wetlands will be evaluated and avoided and/or minimized. Compensatory wetlands mitigation would be performed as necessary to comply with this ARAR. Alternative FDD 4 is the least environmentally damaging practicable alternative that meets the remedial action objectives.
	Floodplains Executive Order (EO11988), 40 CFR 6.302(b), and 40 CFR Part 6, Appendix A	Applicable	The Floodplains Executive Order requires federal agencies to avoid impacts associated with the occupancy and modification of a floodplain unless there is no practicable alternative and the proposed action includes all practicable measure to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the natural and beneficial values of floodplains.	Under the FDDA-4 component of the selected remedy, available practicable means will be used to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the floodplains.

TABLE M-6
ALTERNATIVE FDDA-4
LOCATION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Location	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Surface Water, Wetlands, Floodplains (Cont'd)	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate	These regulations require that a hazardous waste facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout by a 100-year storm.	Under the FDDA-4 component of the selected remedy, any hazardous waste facility, including the the contingent remedy's possible treatment plant, will be designed, constructed, operated, and maintained with all available practicable means to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the floodplains. In areas where the treatment plant will result in the filling in of areas within the 100-year floodplain, there will be a replication of 100-year floodplain space equivalent to the amount loss. Stormwater management basins will be designed to minimize the impact of floods. Any structures will be designed to withstand the effects of a 100-year storm.
	State Regulatory Requirements			
	Massachusetts Wetlands Regulations (310 CMR 10.00; MGL c. 131, Section 40: Wetlands Protection Act)	Applicable	These regulations set performance standards for dredging, filling, and altering of any inland wetland, the buffer zone within 100 feet of a wetland, and the riverfront area (defined as the area between the river's mean annual high-water line and a line located 200 feet away). The requirement also defines wetlands based on vegetation type and requires that effects on wetlands be mitigated. Resource areas at the Site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, riverfront and estimated habitats of rare wildlife. Under this requirement, available alternatives must be considered that minimize the extent of adverse impacts, and mitigation including restoration and/or replication is required.	Under the FDDA-4 component of the selected remedy, the excavation of contaminated soils and the installation of wells and possible treatment plant (if the active groundwater treatment contingency is needed) will occur within the 100 foot buffer zone of wetlands. Because of the contamination in soils in the FDDA, there is no practicable alternative to the excavation of these contaminated soils for consolidation with the Landfill Lobes prior to capping. Similarly, if the active groundwater treatment contingency is needed, wetlands may be unavoidably impacted. All practicable means will be used to avoid or minimize harm to the wetland buffer zone, including erosion and sedimentation controls and stormwater management. The wetland buffer zone area unavoidably disturbed by remedial activities will be mitigated, restored or preserved.
	Massachusetts Water Quality Certification for Discharge of Dredged or Fill Material, Dredging, and Dredging Material Disposal in Waters of the U.S. within the Commonwealth (314 CMR 9.00)	Applicable	For discharges of dredged or fill material: there must be no practicable alternative with less adverse impact on the aquatic ecosystem; appropriate and practicable steps must be taken to avoid and minimize potential adverse impacts to wetlands and land under water; stormwater discharges must be controlled with BMPs; and there must not be substantial adverse impacts to the physical, chemical, or biological integrity of surface waters. For dredging and dredged material management: there must be no practicable alternative with less adverse impact on the aquatic ecosystem; and if avoidance is not possible then minimize, or if neither avoidance or minimization are possible, then mitigate potential adverse impacts.	Under the FDDA-4 component of the selected remedy, the excavation of contaminated soils and the installation of wells and possible treatment plant (if the active groundwater treatment contingency is needed) will occur within the 100 foot buffer zone of wetlands. Because of the contamination in soils in the FDDA, there is no practicable alternative to the excavation of these contaminated soils for consolidation with the Landfill Lobes prior to capping. Similarly, if the active groundwater treatment contingency is needed, wetlands may be unavoidably impacted. All practicable means will be used to avoid or minimize harm to the wetland buffer zone, including erosion and sedimentation controls and stormwater management. The wetland buffer zone area unavoidably disturbed by remedial activities will be mitigated, restored or preserved. There would be no substantial long-term adverse impacts to the integrity of surface waters.

TABLE M-6
ALTERNATIVE FDDA-4
LOCATION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Location	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Surface Water, Wetlands, Floodplains (Cont'd)	Massachusetts Waterways Regulations (310 CMR 9.00)	Applicable	These regulations set forth criteria for work within flowed and filled tidelands and other waterways. Waterways concerns focus on the long term viability of marine uses and protecting public rights in tidelands, including fishing and access.	Under the FDDA-4 component of the selected remedy, the excavation of contaminated soil areas and the installation of wells and possible treatment plant (if the active groundwater treatment contingency is needed) will occur close to delineated wetland boundaries and potentially may disturb some areas. Because of the contamination in soils in the FDDA, there is no practicable alternative to the excavation of these contaminated soils for consolidation with the Landfill Lobes prior to capping. Similarly, if the active groundwater treatment contingency is needed, wetlands may be unavoidably impacted. During remedial design, the effects of remedial activities on the wetlands will be evaluated and avoided and/or minimized. Compensatory wetlands mitigation would be performed as necessary to comply with this ARAR.
	Massachusetts Hazardous Waste Rules, Facility Location Standards (310 CMR 30.700)	Applicable	These regulations set forth criteria for siting hazardous waste facilities within Land Subject to Flooding (as defined under the Massachusetts Wetlands Protection standards); surface water supplies; and actual, planned, or potential public water supplies	Under the FDDA-4 component of the selected remedy, any hazardous waste facility, including the the contingent remedy's possible treatment plant, within Land Subject to Flooding and potential public water supply area, will be designed, constructed, operated, and maintained to prevent a release of hazardous waste within the protected resource area.
Other Natural Resources	**Federal Regulatory Requirements**			
	Endangered Species Act (16 USC 1531 <u>et seq.</u>; 40 CFR 6.302(h); 50 CFR 402)	Applicable if encountered	This statute requires that Federal agencies avoid activities which jeopardize threatened or endangered species or adversely modify habitats essential to their survival. Mitigation measures should be considered if a listed species or habitat may be jeopardized.	No endangered or threatened species have been identified at the Site to date. If endangered or threatened species in the site area are identified, remedial activities would avoid actions that would adversely affect threatened or endangered species or habitats.
	National Historic Preservation Act (16 USC 470 et seq., 36 CFR 800)	Applicable if encountered	Pursuant to Sections 106 and 110(f) of the NHPA, as amended, CERCLA response actions are required to take into account the effects of the response activities on any historic property included or eligible for inclusion on the National Register of Historic Places.	Should the FDDA-4 component of the selected remedy impact historic properties, as determined in the remedial design, activities will be coordinated with the Massachusetts Historical Commission (MHC). If it is determined that adverse impacts are unavoidable, then MHC will be consulted to determine ways to minimize and/or mitigate such adverse impacts.
	State Regulatory Requirements			
	Antiquities Act and Regulations; Massachusetts Historical Commission; Protection of Properties Included in the State Register of Historic Places (M.G.L. ch. 9, sec. 26-27; 950 CMR 70.00)	Applicable if encountered	These regulations require the adoption of all prudent and feasible means to eliminate, minimize or mitigate adverse effects to historic or archaeological properties, and require coordination with the Massachusetts Historical Commission.	Should the FDDA-4 component of the selected remedy impact historic or archaeological properties, as determined in the remedial design, activities will be coordinated with the Massachusetts Historical Commission (MHC). If it is determined that adverse impacts cannot be eliminated, then MHC will be consulted to determine ways to minimize and/or mitigate such adverse impacts.

TABLE M-6
ALTERNATIVE FDDA-4
LOCATION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Location	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Other Natural Resources (Cont'd)	Massachusetts Endangered Species Act, 321 CMR 10.00, (MGL c. 131A)	Applicable if encountered	The Commonwealth of Massachusetts has the authority to research, list, and protect any species deemed endangered, threatened, or of other special concern. These species are listed as either endangered, threatened, or species of special concern in the regulations. Actions must be conducted in a manner that minimizes the effect on Massachusetts-listed endangered species and species listed by the Massachusetts Natural Heritage Program.	No endangered or threatened species have been identified at the Site to date. If endangered or threatened species in the site area are identified, remedial activities would avoid actions that would adversely affect threatened or endangered species or habitats.

TABLE M-7
ALTERNATIVE GSA-2
CHEMICAL SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
	Federal Regulatory Requirements			
Soils	EPA Human Health Assessment Cancer Slope Factors (CSFs)	To be considered	CSFs are developed by EPA for health effects assessments or evaluation by the Human Health Assessment Group. These values present the most up-to-date cancer risk potency information and are used to compute the individual incremental cancer risk resulting from exposure to carcinogens.	CSFs were used to compute the individual cancer risk resulting from exposure to contaminants in soils, and in the development of soil cleanup levels. Under the GSA-2 component of the selected remedy, soils with concentrations above the soil cleanup levels will be excavated to be consolidated with the wastes in the Landfill Lobes prior to capping.

TABLE M-8
ALTERNATIVE GSA-2
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
	Federal Regulatory Requirements			
Waste	RCRA Subtitle C - Hazardous Waste Identification and Listing Regulations (40 CFR Parts 260-262 and 40 CFR 264.13)	Applicable	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. These regulations include rules to identify hazardous waste and a requirement to obtain a detailed chemical and physical analysis of a representative sample of any hazardous wastes prior to treatment, storage, or disposal.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, this requirement was determined to be applicable. Any media generated as part of monitoring activities will be tested for hazardous waste characteristics. If determined to be hazardous waste, then they will be stored, transported, or disposed of in accordance with 40 CFR Part 264.
	RCRA 40 CFR 264 Subpart L, Waste Piles	Applicable if a waste pile is used in the remedial action	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. This regulation establishes requirements for the use of piles for storing or treating hazardous waste.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, if piles are used to store hazardous waste (potentially such as the excavated contaminated soils in GSA prior to consolidation into the landfill lobes), then the FDDA-4 component of the selected remedy can be implemented to comply with this ARAR.
Surface Water	MassDEP Stormwater Management Policy	To be considered	The goal of the policy is to improve water quality and address water quantity problems within Massachusetts through the implementation of performance standards for stormwater management.	The GSA-2 component of the selected remedy will be designed and implemented to comply with this requirement.
Air	Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Applicable	This regulation stipulates that during construction and/or demolition activities, air emissions (i.e. dust, particulates, etc.) must be controlled to prevent air pollution.	Construction activities will be managed to meet the standards for visible emissions (310 CMR 7.06); dust, odor, construction, and demolition (310 CMR 7.09); and noise (310 CMR 7.10).

TABLE M-9
ALTERNATIVE GSA-2
LOCATION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Location	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
	Federal Regulatory Requirements and Guidance			
Surface Water, Wetlands, Floodplains	Wetlands Executive Order (EO11990), 40 CFR 6.302(a), and 40 CFR Part 6, Appendix A	Applicable	The Wetlands Executive Order requires federal agencies to avoid undertaking or providing assistance for new construction located in wetlands unless there is no practicable alternative and the proposed action includes all practicable measures to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands.	Under the GSA-2 component of the selected remedy, the excavation of contaminated soil areas will occur near but outside delineated wetland boundaries. During remedial design the effects of remedial activities on the wetlands will be evaluated and avoided and/or minimized. Compensatory wetlands mitigation will be performed as necessary to comply with this ARAR for those unavoidable minimal impacts. Alternative GSA-2 is the least environmentally damaging practicable alternative that meets the remedial action objectives.
	Clean Water Act Section 404 Dredge and Fill Regulations (40 CFR 230, 33 CFR 320-323)	Applicable	These regulations outline the requirements for the discharge of dredged or fill materials into surface waters including wetlands. No activity that impacts waters of the United States shall be permitted if a practicable alternative that has less adverse impact exists. If there is no other practicable alternative, the impacts must be mitigated.	Under the GSA-2 component of the selected remedy, the excavation of contaminated soil areas will occur near but outside delineated wetland boundaries. During remedial design the effects of remedial activities on the wetlands will be evaluated and minimized. Compensatory wetlands mitigation will be performed as necessary to comply with this ARAR for those unavoidable minimal impacts.
	Floodplains Executive Order (EO11988), 40 CFR 6.302(b), and 40 CFR Part 6, Appendix A	Applicable	The Floodplains Executive Order requires federal agencies to avoid impacts associated with the occupancy and modification of a floodplain unless there is no practicable alternative and the proposed action includes all practicable measure to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the natural and beneficial values of floodplains.	Under the GSA-2 component of the selected remedy, available practicable means will be used to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the floodplains.
	State Regulatory Requirements			
	Massachusetts Wetlands Regulations (310 CMR 10.00; MGL c. 131, Section 40: Wetlands Protection Act)	Applicable	These regulations set performance standards for dredging, filling, and altering of any inland wetland, the buffer zone within 100 feet of a wetland, and the riverfront area (defined as the area between the river's mean annual high-water line and a line located 200 feet away). The requirement also defines wetlands based on vegetation type and requires that effects on wetlands be mitigated. Resource areas at the Site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, riverfront and estimated habitats of rare wildlife. Under this requirement, available alternatives must be considered that minimize the extent of adverse impacts, and mitigation including restoration and/or replication is required.	Under the GSA component of the selected remedy, some of the excavation of contaminated soils may occur within the 100 foot buffer zone of wetlands. Because of the contamination in soils in the GSA, there is no practicable alternative to the excavation of these contaminated soils for consolidation with the Landfill Lobes prior to capping. All practicable means will be used to avoid or minimize harm to the wetland buffer zone, including erosion and sedimentation controls and stormwater management. The wetland buffer zone area unavoidably disturbed by remedial activities will be mitigated, restored or preserved.

TABLE M-9
ALTERNATIVE GSA-2
LOCATION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Location	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Surface Water, Wetlands, Floodplains (Cont'd)	Massachusetts Water Quality Certification for Discharge of Dredged or Fill Material, Dredging, and Dredging Material Disposal in Waters of the U.S. within the Commonwealth (314 CMR 9.00)	Applicable	For discharges of dredged or fill material: there must be no practicable alternative with less adverse impact on the aquatic ecosystem; appropriate and practicable steps must be taken to avoid and minimize potential adverse impacts to wetlands and land under water; stormwater discharges must be controlled with BMPs; and there must not be substantial adverse impacts to the physical, chemical, or biological integrity of surface waters. For dredging and dredged material management: there must be no practicable alternative with less adverse impact on the aquatic ecosystem; and if avoidance is not possible then minimize, or if neither avoidance or minimization are possible, then mitigate potential adverse impacts.	Under the GSA component of the selected remedy, some of the excavation of contaminated soils may occur within the 100 foot buffer zone of wetlands. Because of the contamination in soils in the GSA, there is no practicable alternative to the excavation of these contaminated soils for consolidation with the Landfill Lobes prior to capping. All practicable means will be used to avoid or minimize harm to the wetland buffer zone, including erosion and sedimentation controls and stormwater management. The wetland buffer zone area unavoidably disturbed by remedial activities will be mitigated, restored or preserved. There would be no substantial long-term adverse impacts to the integrity of surface waters.
	Massachusetts Waterways Regulations (310 CMR 9.00)	Applicable	These regulations set forth criteria for work within flowed and filled tidelands and other waterways. Waterways concerns focus on the long term viability of marine uses and protecting public rights in tidelands, including fishing and access.	Under the GSA-2 component of the selected remedy, the excavation of contaminated soil areas will occur near but outside delineated wetland boundaries. During remedial design the effects of remedial activities on the wetlands will be evaluated and avoided and/or minimized. Compensatory wetlands mitigation will be performed as necessary to comply with this ARAR for those unavoidable minimal impacts.
Other Natural Resources	**Federal Regulatory Requirements**			
	Endangered Species Act (16 USC 1531 et seq.; 40 CFR 6.302(h); 50 CFR 402)	Applicable if encountered	This statute requires that Federal agencies avoid activities which jeopardize threatened or endangered species or adversely modify habitats essential to their survival. Mitigation measures should be considered if a listed species or habitat may be jeopardized.	No endangered or threatened species have been identified at the Site to date. If endangered or threatened species in the site area are identified, remedial activities would avoid actions that would adversely affect threatened or endangered species or habitats.
	National Historic Preservation Act (16 USC 470 et seq., 36 CFR 800)	Applicable if encountered	Pursuant to Sections 106 and 110(f) of the NHPA, as amended, CERCLA response actions are required to take into account the effects of the response activities on any historic property included or eligible for inclusion on the National Register of Historic Places.	Should the GSA-2 component of the selected remedy impact historic properties, as determined in the remedial design, activities will be coordinated with the Massachusetts Historical Commission (MHC). If it is determined that adverse impacts are unavoidable, then MHC will be consulted to determine ways to minimize and/or mitigate such adverse impacts.
	State Regulatory Requirements			
	Antiquities Act and Regulations; Massachusetts Historical Commission; Protection of Properties Included in the State Register of Historic Places (M.G.L. ch. 9, sec. 26-27; 950 CMR 70.00)	Applicable if encountered	These regulations require the adoption of all prudent and feasible means to eliminate, minimize or mitigate adverse effects to historic or archaeological properties, and require coordination with the Massachusetts Historical Commission.	Should the GSA-2 component of the selected remedy impact historic or archaeological properties, as determined in the remedial design, activities will be coordinated with the Massachusetts Historical Commission (MHC). If it is determined that adverse impacts cannot be eliminated, then MHC will be consulted to determine ways to minimize and/or mitigate such adverse impacts.
	Massachusetts Endangered Species Act, 321 CMR 10.00, (MGL c. 131A)	Applicable if encountered	The Commonwealth of Massachusetts has the authority to research, list, and protect any species deemed endangered, threatened, or of other special concern. These species are listed as either endangered, threatened, or species of special concern in the regulations. Actions must be conducted in a manner that minimizes the effect on Massachusetts-listed endangered species and species listed by the Massachusetts Natural Heritage Program.	No endangered or threatened species have been identified at the Site to date. If endangered or threatened species in the site area are identified, remedial activities would avoid actions that would adversely affect threatened or endangered species or habitats.

TABLE M-10
ALTERNATIVE DGGW-2
CHEMICAL SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Groundwater	**Federal Regulatory Requirements**			
	Federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) (40 CFR Part 141)	Relevant and appropriate	MCLs are enforceable standards that regulate the concentration of specific organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water supplies. MCLs are relevant and appropriate for the groundwater at the Site because the aquifer is a potential source of drinking water.	MCLs were used in determining groundwater preliminary remediation goals (PRGs) for site contaminants where such contaminant levels have been established. Under the DGGW-2 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the DGGW achieving PRGs.
	EPA Risk Reference Doses (RfDs)	To be considered	RfDs are dose levels developed by EPA for use in estimating the non-carcinogenic risk resulting from exposure to toxic substances.	RfDs were used to assess health risks due to exposure to non-carcinogenic chemicals in groundwater, and to develop of acceptable groundwater PRG concentrations. Under the DGGW-2 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the DGGW achieving PRGs.
	EPA Human Health Assessment Cancer Slope Factors (CSFs)	To be considered	CSFs are developed by EPA for health effects assessments or evaluation by the Human Health Assessment Group. These values present the most up-to-date cancer risk potency information and are used to compute the individual incremental cancer risk resulting from exposure to carcinogens.	CSFs were used to compute the individual cancer risk resulting from exposure to contaminants in groundwater, and in the development of acceptable groundwater PRG concentrations. Under the DGGW-2 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the DGGW achieving PRGs.
	Guidelines for Carcinogen Risk Assessment (EPA/630/P-03/001F, March 2005)	To be considered	Guidance values were used to evaluate the potential carcinogenic hazard caused by exposure to contaminants.	Cancer risks identified will be addressed by the DGGW-2 component of the selected remedy.
	Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (EPA/630/R-03/003F, March 2005)	To be considered	Guidance values were used to evaluate the potential carcinogenic hazard to children caused by exposure to contaminants.	Child cancer risks identified will be addressed by the DGGW-2 component of the selected remedy.
	EPA Office of Water, Drinking Water Health Advisories EPA 822-R-06-013	To be considered	Health Advisories (HAs) are estimates of acceptable drinking water levels for chemical substances based on health affects information; an HA is not a legally enforceable Federal standard, but serves as technical guidance to assist federal, state and local officials. HAs were used if constituents did not have promulgated MCLs.	HAs were used to develop acceptable groundwater PRG concentrations. Under the DGGW-2 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the DGGW achieving PRGs.
	State Regulatory Requirements			
	Massachusetts Groundwater Quality Standards (314 CMR 6.00)	Applicable	These standards consist of ground water classifications, which designate and assign the uses for which the various ground waters of the Commonwealth shall be maintained and protected; water quality criteria necessary to sustain the designated uses; and regulations necessary to achieve the designated uses or maintain the existing ground water quality. The GWQSs set numeric limits for certain contaminants as well as a pH range. They were used when they were more stringent than Federal MCLs.	Groundwater beneath the Site is mapped in a potentially productive aquifer with the potential for potable water use. Under the DGGW-2 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the DGGW achieving PRGs.

TABLE M-10
ALTERNATIVE DGGW-2
CHEMICAL SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Groundwater (Cont'd)	Massachusetts Drinking Water Standards (310 CMR 22.00)	Relevant and appropriate	These standards establish Massachusetts MCLs for organic and inorganic contaminants that have been determined to adversely affect human health in public drinking water systems. The aquifer on-site is not a public water system, but these requirements are R&A because the aquifer has the potential to be used as a source of drinking water. These requirements were used when they were more stringent than Federal MCLs.	Under the DGGW-2 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the DGGW achieving PRGs.
	Massachusetts DEP Office of Research and Standards Guidelines (ORSGs)	To be considered	The Massachusets DEP Office of Research and Standards issues guidance for chemicals other than those with Massachusetts MCLs in drinking water. ORSGs are concentration of chemicals in drinking water, at or below which, adverse health effects are unlikely to occur after chronic (lifetime) exposure. These guidance values were used when constituents did not have promulgated MCLs.	Under the DGGW-2 component of the selected remedy, MNA (with a contingency for active groundwater treatment) will over time result in the groundwater in the DGGW achieving PRGs.

TABLE M-11
ALTERNATIVE DGGW-2
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Regulatory Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
	Federal Regulatory Requirements			
Waste	RCRA Subtitle C - Hazardous Waste Identification and Listing Regulations (40 CFR Parts 260-262 and 40 CFR 264.13)	Applicable	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. These regulations include rules to identify hazardous waste and a requirement to obtain a detailed chemical and physical analysis of a representative sample of any hazardous wastes prior to treatment, storage, or disposal.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, this requirement was determined to be applicable. Any media generated as part of monitoring activities and groundwater extraction and treatment will be tested for hazardous waste characteristics. If determined to be hazardous waste, then they will be stored, transported, or disposed of in accordance with 40 CFR Part 264.
	RCRA 40 CFR 264 Subpart I, Use and Management of Containers	Applicable if containers are used in the remedial action	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. This regulation establishes requirements for the storage of containers of hazardous waste.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, if the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if a container is used to store hazardous waste, then DGGW-2 will be implemented to comply with this ARAR.
	RCRA 40 CFR 264 Subpart J, Tank Systems	Applicable if tank systems are used in the remedial action	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. This regulation establishes requirements for the use of tank systems for storing or treating hazardous waste.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, if the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if a tank system is used to store hazardous waste, then DGGW-2 will be implemented to comply with this ARAR.
	RCRA 40 CFR 264 Subpart X, Miscellaneous Units	Applicable if miscellaneous units are used in the remedial action	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. These provisions have been adopted by the State. This regulation establishes requirements for the use of miscellaneous units for treating, storing, or disposing of hazardous waste.	Because RCRA-type (listed or characteristic) hazardous wastes were disposed of at the Site during the operation of the landfill, if the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if a miscellaneous unit is used to store hazardous waste, then DGGW-2 will be implemented to comply with this ARAR.
	RCRA 40 CFR 264 Subpart AA, Air Emission Standards for Process Vents	Applicable if thresholds are met	This regulation establishes air emission standards for process vents, closed-vent systems, and control devices at hazardous waste facilities.	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy, if a process vent is used in the remedial action and if applicable thresholds are met, then air emission controls will be implemented during groundwater treatment to comply with this regulation.
	RCRA 40 CFR 264 Subpart BB, Air Emission Standards for Equipment Leaks	Applicable if thresholds are met	This regulation contains air pollutant emission standards for equipment leaks at hazardous waste TSD facilities. This subpart applies to equipment that contains or contacts hazardous wastes with organic concentrations of at least 10 percent by weight.	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if equipment covered by this standard is used in the remedial action and handles hazardous wastes at concentrations that meet this rule's threshold, then a leak detection and repair program will be implemented during groundwater treatment to comply with this regulation.

TABLE M-11
ALTERNATIVE DGGW-2
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Waste (cont'd)	RCRA 40 CFR 264 Subpart CC, Air Emission Standards for Tanks, Surface Impoundments and Containers	Applicable if thresholds are met	This regulation establishes air emission standards for facilities that treat, store, or dispose hazardous wastes in tanks, surface impoundments, or containers.	Any media generated as part of monitoring activities and groundwater treatment (if the contingency is needed) will be tested for hazardous waste characteristics. If determined to be hazardous waste, then they will be stored, transported, or disposed of in accordance with 40 CFR Part 264. If a tank or container is used in the remedial action and if applicable thresholds are met, then air emission controls will be implemented during groundwater treatment to comply with this regulation.
	RCRA 40 CFR 264 Subpart DD, Containment Buildings	Applicable	This regulation contains design, operating, closure and post-closure standards and requirements for the storage and treatment of hazardous waste in containment buildings.	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if a building is used to house treatment equipment, then the design, operation, closure, and post-closure of the treatment building for DGGW-2 will comply with this regulation.
Surface Water	**Federal Regulatory Requirements**			
	Clean Water Act Section 402 National Pollutant Discharge Elimination System (NPDES) (40 CFR Part 122-125 and 131)	Applicable	This act and regulations establish discharge limitations, monitoring requirements, and best management practices. Point-source discharges of effluent to surface water must comply with NPDES requirements (e.g., federal and state ambient water quality criteria (AWQC)).	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy, on-site discharges to surface waters, including Sutton Brook and adjacent wetlands, shall meet these substantive discharge standards. These discharge limitations shall also be used to develop monitoring standards for surface waters.
	Clean Water Act (CWA) Ambient Water Quality Criteria (AWQC) (33 USC 1251 *et seq.*) (40 CFR 122.44)	Relevant and appropriate	Federal AWQC are recommended (non-enforceable) criteria published by EPA and provided to the States. AWQC are listed for protection of ecological and human health for approximately 160 contaminants. AWQC are used in establishing State water quality standards.	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if treated groundwater is discharged to surface water, it will be treated as needed to comply with State water quality standards based on AWQC. Surface water monitoring will be performed. These standards will be used to help assess the effectiveness of the groundwater treatment.
	Clean Water Act (CWA) Pretreatment Regulations for Discharges to a POTW (40 CFR Part 403	Applicable if treated groundwater is discharged to the POTW	These regulations prohibit the introduction of pollutants into a publicly owned treatment works (POTW) and has pretreatment requirements for sources to a POTW	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if treated groundwater is discharged to the local POTW, it will be treated as need to comply with these pretreatment requirements.
	State Regulatory Requirements			
	Mass. Clean Waters Act - MassDEP Surface Water Discharge Permit Program (314 CMR 3.00; MGL c. 21 Sections 26-53)	Applicable	This act and program establish the requirements intended to maintain the quality of surface waters by controlling the direct discharge of pollutants to surface waters. Direct discharge of wastewater to surface waters must meet effluent discharge limits established by this program.	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy, on-site discharges to surface waters, including Sutton Brook and adjacent wetlands, shall meet these substantive discharge standards. These discharge limitations shall also be used to develop monitoring standards for surface waters.

TABLE M-11
ALTERNATIVE DGGW-2
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Surface Water (Cont'd)	Massachusetts Surface Water Quality Standards (314 CMR 4.00)	Applicable	The Massachusetts Surface Water Quality Standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected; which prescribe the minimum water quality criteria required to sustain the designated uses; and which contain regulations necessary to achieve the designated uses and maintain existing water quality including, where appropriate, the prohibition of discharges. These regulations limit or prohibit discharges of pollutants to surface waters to ensure that the surface water quality standards of the receiving waters are protected and maintained or attained.	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy, on-site discharges to surface waters, including Sutton Brook and adjacent wetlands, shall meet these substantive discharge standards. These discharge limitations shall also be used to develop monitoring standards for surface waters.
	MassDEP Surface Water Discharge Permit Program (314 CMR 3.00)	Applicable	These regulations are intended to protect surface water bodies in the Commonwealth by regulating the discharge into them. Direct discharges of wastewater to surface waters must meet effluent discharge limits established by this program.	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy, on-site discharges to surface waters, including Sutton Brook and adjacent wetlands, shall meet these substantive discharge standards. These discharge limitations shall also be used to develop monitoring standards for surface waters.
	Massachusetts Pretreatment Standards for Discharges to Wastewater Treatment Works (314 CMR 12.00)	Applicable	These regulations prohibit the introduction of pollutants into a publicly owned treatment works (POTW) and has pretreatment requirements for sources to a POTW	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if treated groundwater is discharged to the local POTW, it will be treated as need to comply with these pretreatment requirements.
Groundwater	**Federal Regulatory Requirements**			
	RCRA Subtitle C - Releases from Solid Waste Management Units (40 CFR Subpart F, 264.95 and 264.96(a) and (c))	Applicable	These regulations identify specific monitoring requirements applicable to hazardous waste facilities, including specifying the point of compliance at which the groundwater protection standards apply and at which monitoring must be conducted, as well as specifying the compliance period during which the groundwater protection standard applies.	The DGGW-2 component of the selected remedy will be implemented to comply with these requirements. Because EPA has determined that the point of compliance at which the groundwater protection standards apply is the edge of the waste management unit (the landfill lobes), these standards will be met throughout the DGGW area.
	Underground Injection (40 CFR Part 144)	Relevant and appropriate	These regulations provide regulatory compliance standards for treatment facilities that inject wastes underground. The use at wells to dispose of hazardous waste is prohibited.	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if the performance of the DGGW-2 component of the selected remedy utilizes underground injection for the treated groundwater or uses an infiltration gallery or any other system that disposes of treatment water or waste into groundwater as the remediation technology, groundwater will be treated to be non-hazardous prior to subsurface discharge.
	Final OSWER Directive "Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites (OSWER Dir. 9200.4-17P, 4/12/99)	To be considered	This guidance sets criteria for evaluating monitored natural attenuation as a remedy at, among others, Superfund sites.	For the DGGW-2 component of the selected remedy, monitored natural attenuation was determined to be appropriate in accordance with this TBC. Under DGGW-2, contaminant levels in the groundwater plume underneath the DGGW area will be monitored consistent with this guidance. Active groundwater treatment is retained as a contingency if determined to be necessary as described in Part 2 of the ROD.

TABLE M-11
ALTERNATIVE DGGW-2
ACTION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Media	[illegible]	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Groundwater (Cont'd)	**State Regulatory Requirements**			
	MassDEP Underground Injection Control Regulations (310 CMR 27.00)	Applicable	These regulations are intended to protect underground sources of drinking water by regulating the underground injection of hazardous wastes, fluids used for extraction of minerals, oil, and energy, and any other fluids having potential to contaminate groundwater.	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if the performance of the DGGW-2 component of the selected remedy utilizes underground injection for the treated groundwater or uses an infiltration gallery or any other system that disposes of treatment water or waste into groundwater as the remediation technology, groundwater will be treated to be non-hazardous prior to subsurface discharge.
	MassDEP Groundwater Discharge Permit Program (314 CMR 5.00)	Applicable	These regulations are intended to protect groundwater quality by controlling the discharge of pollutants to the ground waters of the Commonwealth to assure that these waters are protected for their highest potential use. These regulations set effluent limits for the discharge of pollutants to groundwater.	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if this contingent remedy utilizes underground injection, infiltration gallery or any other system that disposes of treatment water or waste into groundwater as the remediation technology, groundwater will be treated to meet the substantive requirements of these regulations prior to subsurface discharge.
	Massachusetts Well Decommissioning Requirements (313 CMR 3.03)	Applicable	These regulations provide for certain notification requirements upon well abandonment.	These regulations will be followed to the extent that the alternative involves decommissioning any wells.
Air	**Federal Regulatory Requirements**			
	Clean Air Act National Emissions Standards for Hazardous Air Pollutants (NESHAPs), 40 CFR Part 61	Applicable	These regulations set standards for emissions of 189 Hazardous Air Pollutants that are listed in Section 112(b)(1) of the Clean Air Act.	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if air stripping is used and any of the 189 hazardous air pollutants are emitted, then DGGW-2 will comply with this ARAR.
	OSWER Directive 9355.0-28, Air Stripper Control Guidance, 7/12/89	To be considered	This OSWER directive establishes guidance on the control of air emissions from air strippers used at Superfund sites for groundwater treatment.	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if air stripping is used, then DGGW-2 will comply with this policy.
	State Regulatory Requirements			
	Massachusetts Ambient Air Quality Standards (310 CMR 6.00)	Applicable	These regulations set primary and secondary standards for emissions of sulfur oxides, particulate matter, carbon monoxide, ozone, nitrogen dioxide, and lead.	If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if air stripping is used, then DGGW-2 will comply with this policy. No air emissions from remedial treatment will cause ambient air quality standards to be exceeded.
	MassDEP Revised Ambient Air Guidelines (December 6, 1995)	To be considered	This document presents MassDEP's revised ambient air guidelines, presenting the Threshold Effects Exposure Limits (TELs) and Allowable Ambient Limits (AALs).	The DGGW-2 component of the selected remedy will be designed and implemented to comply with this policy.
	Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Applicable	This regulation stipulates that during construction and/or demolition activities, air emissions (i.e. dust, particulates, etc.) must be controlled to prevent air pollution.	Construction activities will be managed to meet the standards for visible emissions (310 CMR 7.06); dust, odor, construction, and demolition (310 CMR 7.09); and noise (310 CMR 7.10). If the active groundwater treatment contingency is needed for the DGGW-2 component of the selected remedy and if air stripping is used, then DGGW-2 will comply with this ARAR. Odor emissions from the groundwater treatment air stripper will be controlled with best available control technology.

TABLE M-12
ALTERNATIVE DGGW-2
LOCATION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Location	[illegible]/Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Surface Water, Wetlands, Floodplains	**Federal Regulatory Requirements and Guidance**			
	Wetlands Executive Order (EO11990), 40 CFR 6.302(a), and 40 CFR Part 6, Appendix A	Applicable	The Wetlands Executive Order requires federal agencies to avoid undertaking or providing assistance for new construction located in wetlands unless there is no practicable alternative and the proposed action includes all practicable measures to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands.	If the active groundwater treatment contingency for the DGGW-2 component of the selected remedy is needed, the installation of wells and possible treatment plant may unavoidably impact wetlands. During remedial design, the effects of remedial activities on the wetlands will be evaluated and minimized. Compensatory wetlands mitigation will be performed as necessary to comply with this ARAR for those unavoidable minimal impacts.
	Clean Water Act Section 404 Dredge and Fill Regulations (40 CFR 230, 33 CFR 320-323)	Applicable	These regulations outline the requirements for the discharge of dredged or fill materials into surface waters including wetlands. No activity that impacts waters of the United States shall be permitted if a practicable alternative that has less adverse impact exists. If there is no other practicable alternative, the impacts must be mitigated.	If the active groundwater treatment contingency for the DGGW-2 component of the selected remedy is needed, the installation of wells and possible treatment plant may unavoidably impact wetlands. During remedial design, the effects of remedial activities on the wetlands will be evaluated and avoided and/or minimized. Compensatory wetlands mitigation will be performed as necessary to comply with this ARAR for those unavoidable minimal impacts. Alternative DGGW-2 is the least environmentally damaging practicable alternative that meets the remedial action objectives.
	Floodplains Executive Order (EO11988), 40 CFR 6.302(b), and 40 CFR Part 6, Appendix A	Applicable	The Floodplains Executive Order requires federal agencies to avoid impacts associated with the occupancy and modification of a floodplain unless there is no practicable alternative and the proposed action includes all practicable measure to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the natural and beneficial values of floodplains.	Under the DGGW-2 component of the selected remedy, available practicable means will be used to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the floodplains. In areas where the landfill cover will result in the filling in of areas within the 100-year floodplain, there will be a replication of 100-year floodplain space equivalent to the amount loss by the final cover. Stormwater management basins will be designed to minimize the impact of floods.
	RCRA Floodplain Restrictions for Hazardous Waste Facilities (40 CFR 264.18(b))	Relevant and Appropriate	These regulations require that a hazardous waste facility located in a 100-year floodplain must be designed, constructed, operated, and maintained to prevent washout by a 100-year storm.	Under the DGGW-2 component of the selected remedy, hazardous waste facility, including the the contingent remedy's possible treatment plant, will be designed, constructed, operated, and maintained with all available practicable means to reduce the risk of flood loss, to minimize the impact of floods, and to restore and preserve the floodplains. In areas where the treatment plant will result in the filling in of areas within the 100-year floodplain, there will be a replication of 100-year floodplain space equivalent to the amount loss. Stormwater management basins will be designed to minimize the impact of floods. Any structures will be designed to withstand the effects of a 100-year storm.

TABLE M-12
ALTERNATIVE DGGW-2
LOCATION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Location	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
	State Regulatory Requirements			
Surface Water, Wetlands, Floodplains (Cont'd)	Massachusetts Wetlands Regulations (310 CMR 10.00; MGL c. 131, Section 40: Wetlands Protection Act)	Applicable	These regulations set performance standards for dredging, filling, and altering of any inland wetland, the buffer zone within 100 feet of a wetland, and the riverfront area (defined as the area between the river's mean annual high-water line and a line located 200 feet away). The requirement also defines wetlands based on vegetation type and requires that effects on wetlands be mitigated. Resource areas at the Site covered by the regulations include banks, bordering vegetated wetlands, land under bodies of water, land subject to flooding, riverfront and estimated habitats of rare wildlife. Under this requirement, available alternatives must be considered that minimize the extent of adverse impacts, and mitigation including restoration and/or replication is required.	Under the DGGW-2 component of the selected remedy, the installation of wells and possible treatment plant (if the active groundwater treatment contingency is needed) will occur within the 100 foot buffer zone of wetlands and the riverfront area. If the active groundwater treatment contingency is needed, wetlands and the riverfront area may be unavoidably impacted. All practicable means will be used to avoid or minimize harm to the wetland buffer zone and the riverfront area, including erosion and sedimentation controls and stormwater management. The wetland buffer zone area and riverfront area unavoidably disturbed by remedial activities will be mitigated, restored or preserved.
	Massachusetts Water Quality Certification for Discharge of Dredged or Fill Material, Dredging, and Dredging Material Disposal in Waters of the U.S. within the Commonwealth (314 CMR 9.00)	Applicable	For discharges of dredged or fill material: there must be no practicable alternative with less adverse impact on the aquatic ecosystem; appropriate and practicable steps must be taken to avoid and minimize potential adverse impacts to wetlands and land under water; stormwater discharges must be controlled with BMPs; and there must not be substantial adverse impacts to the physical, chemical, or biological integrity of surface waters. For dredging and dredged material management: there must be no practicable alternative with less adverse impact on the aquatic ecosystem; and if avoidance is not possible then minimize, or if neither avoidance or minimization are possible, then mitigate potential adverse impacts.	Under the DGGW-2 component of the selected remedy, the installation of wells and possible treatment plant (if the active groundwater treatment contingency is needed) will occur within the 100 foot buffer zone of wetlands and the riverfront area. If the active groundwater treatment contingency is needed, wetlands and the riverfront area may be unavoidably impacted. All practicable means will be used to avoid or minimize harm to the wetland buffer zone and the riverfront area, including erosion and sedimentation controls and stormwater management. The wetland buffer zone area and riverfront area unavoidably disturbed by remedial activities will be mitigated, restored or preserved. There would be no substantial long-term adverse impacts to the integrity of surface waters.
	Massachusetts Waterways Regulations (310 CMR 9.00)	Applicable	These regulations set forth criteria for work within flowed and filled tidelands and other waterways. Waterways concerns focus on the long term viability of marine uses and protecting public rights in tidelands, including fishing and access.	If the active groundwater treatment contingency for the DGGW-2 component of the selected remedy is needed, the installation of wells and possible treatment plant may unavoidably impact wetlands. During remedial design, the effects of remedial activities on the wetlands will be evaluated and avoided and/or minimized. Compensatory wetlands mitigation will be performed as necessary to comply with this ARAR for those unavoidable minimal impacts.
	Massachusetts Hazardous Waste Rules, Facility Location Standards (310 CMR 30.700)	Applicable	These regulations set forth criteria for siting hazardous waste facilities within Land Subject to Flooding (as defined under the Massachusetts Wetlands Protection standards); surface water supplies; and actual, planned, or potential public water supplies	Under the DGGW-2 component of the selected remedy, any hazardous waste facility, including the the contingent remedy's possible treatment plant, within Land Subject to Flooding and potential public water supply area, will be designed, constructed, operated, and maintained to prevent a release of hazardous waste within the protected resource area.

TABLE M-12
ALTERNATIVE DGGW-2
LOCATION SPECIFIC ARARs and TBCs
Sutton Brook Disposal Area Superfund Site, Tewksbury, Massachusetts

Location	Requirement	Status	Summary of Requirement	Actions to be Taken to Attain Requirement
Other Natural Resources	**Federal Regulatory Requirements**			
	Endangered Species Act (16 USC 1531 et seq.; 40 CFR 6.302(h); 50 CFR 402)	Applicable if encountered	This statute requires that Federal agencies avoid activities which jeopardize threatened or endangered species or adversely modify habitats essential to their survival. Mitigation measures should be considered if a listed species or habitat may be jeopardized.	No endangered or threatened species have been identified at the Site to date. If endangered or threatened species in the site area are identified, remedial activities would avoid actions that would adversely affect threatened or endangered species or habitats.
	National Historic Preservation Act (16 USC 470 et seq., 36 CFR 800)	Applicable if encountered	Pursuant to Sections 106 and 110(f) of the NHPA, as amended, CERCLA response actions are required to take into account the effects of the response activities on any historic property included or eligible for inclusion on the National Register of Historic Places.	Should the DGGW-2 component of the selected remedy impact historic properties, as determined in the remedial design, activities will be coordinated with the Massachusetts Historical Commission (MHC). If it is determined that adverse impacts are unavoidable, then MHC will be consulted to determine ways to minimize and/or mitigate such adverse impacts.
	State Regulatory Requirements			
	Antiquities Act and Regulations; Massachusetts Historical Commission; Protection of Properties Included in the State Register of Historic Places (M.G.L. ch. 9, sec. 26-27; 950 CMR 70.00)	Applicable if encountered	These regulations require the adoption of all prudent and feasible means to eliminate, minimize or mitigate adverse effects to historic or archaeological properties, and require coordination with the Massachusetts Historical Commission.	Should the DGGW-2 component of the selected remedy impact historic or archaeological properties, as determined in the remedial design, activities will be coordinated with the Massachusetts Historical Commission (MHC). If it is determined that adverse impacts cannot be eliminated, then MHC will be consulted to determine ways to minimize and/or mitigate such adverse impacts.
	Massachusetts Endangered Species Act, 321 CMR 10.00, (MGL c. 131A)	Applicable if encountered	The Commonwealth of Massachusetts has the authority to research, list, and protect any species deemed endangered, threatened, or of other special concern. These species are listed as either endangered, threatened, or species of special concern in the regulations. Actions must be conducted in a manner that minimizes the effect on Massachusetts-listed endangered species and species listed by the Massachusetts Natural Heritage Program.	No endangered or threatened species have been identified at the Site to date. If endangered or threatened species in the site area are identified, remedial activities would avoid actions that would adversely affect threatened or endangered species or habitats.

Appendix E

Administrative Record Index and Guidance Documents

Sutton Brook
NPL Site Administrative Record File
Record of Decision (ROD)
Operable Unit 1 - Sitewide

Index

ROD Dated September 2007
Released October 2007

Prepared by
EPA New England
Office of Site Remediation & Restoration

Introduction to the Collection

This is the administrative record for the Sutton Brook Superfund Site, Tewksbury, MA, Operable Unit 1, Record of Decision (ROD), released September, 2007. The file contains site-specific documents and a list of guidance documents used by EPA staff in selecting a response action at the site.

This administrative record should replace the Proposed Plan for Record of Decision administrative record file dated June 2007. This file includes, by reference, the administrative record file for the Sutton Brook Removal Action, issued July 20, 2000.

The administrative record file is available for review at:

EPA New England Office of
Site Remediation & Restoration
(OSRR) Records and Information Center
1 Congress Street, Suite 1100 (HSC)
Boston, MA 02114
(by appointment)
617-918-1440 (phone)
617-918-1223 (fax)
www.epa.gov/region01/superfund/resource/records.htm

Tewksbury Public Library
300 Chandler Street
Tewksbury, MA 01876
(978) 640-4490 (phone)
http://www.tewksburypl.org/

Questions about this administrative record file should be directed to the EPA New England site manager.

An administrative record file is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

03: REMEDIAL INVESTIGATION (RI)

273524 **GROUNDWATER USE AND VALUE DETERMINATION**

Author: US EPA REGION 1
Addressee:
Doc Type: REPORT
Doc Date: 07/01/2001 **# of Pages:** 5
File Break: 03.06

273538 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) MAY 2004 (6/14/2004 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Type: REPORT
Doc Date: 05/01/2004 **# of Pages:** 3
File Break: 03.06

273539 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) JUNE 2004 (7/14/2004 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Type: REPORT
Doc Date: 06/01/2004 **# of Pages:** 3
File Break: 03.06

273540 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) JULY 2004 (8/13/2004 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Type: REPORT
Doc Date: 07/01/2004 **# of Pages:** 3
File Break: 03.06

03: REMEDIAL INVESTIGATION (RI)

273541 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) AUGUST 2004 (9/14/2004 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 08/01/2004 **# of Pages:** 4
File Break: 03.06
Doc Type: REPORT

273542 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) SEPTEMBER 2004 (10/14/2004 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 09/01/2004 **# of Pages:** 5
File Break: 03.06
Doc Type: REPORT

273543 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) OCTOBER 2004 (11/14/2004 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 10/01/2004 **# of Pages:** 4
File Break: 03.06
Doc Type: REPORT

273544 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) NOVEMBER 2004 (12/14/2004 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 11/01/2004 **# of Pages:** 5
File Break: 03.06
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

273520 **REQUEST FOR ADDITIONAL MONITORING LOCATION**

Author: KARL D KASPER WOODARD & CURRAN INC
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 11/19/2004 **# of Pages:** 2
File Break: 03.02
Doc Type: LETTER

273546 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) DECEMBER 2004 (1/14/2005 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 12/01/2004 **# of Pages:** 4
File Break: 03.06
Doc Type: REPORT

273545 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) JANUARY 2005 (2/14/2005 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 01/01/2005 **# of Pages:** 3
File Break: 03.06
Doc Type: REPORT

273547 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) FEBRUARY 2005 (3/11/2005 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 02/01/2005 **# of Pages:** 3
File Break: 03.06
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

273548 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) MARCH 2005 (4/14/2005 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Type: REPORT
Doc Date: 03/01/2005 **# of Pages:** 3
File Break: 03.06

273526 **REVIEW OF DRAFT REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS) PHASE 1A REMEDIAL INVESTIGATION (RI) DELIVERABLE, MASTER COMMENT LIST**

Author: US EPA REGION 1
Addressee:
Doc Type: MEMO
Doc Date: 03/04/2005 **# of Pages:** 24
File Break: 03.06

273549 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) APRIL 2005 (5/13/2005 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Type: REPORT
Doc Date: 04/01/2005 **# of Pages:** 3
File Break: 03.06

273550 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) MAY 2005 (6/13/2005 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Type: REPORT
Doc Date: 05/01/2005 **# of Pages:** 11
File Break: 03.06

03: REMEDIAL INVESTIGATION (RI)

273551 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) JUNE 2005 (7/14/2005 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 06/01/2005 **# of Pages:** 3
File Break: 03.06
Doc Type: REPORT

273552 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) JULY 2005 (8/12/2005 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 07/01/2005 **# of Pages:** 3
File Break: 03.06
Doc Type: REPORT

273553 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) AUGUST 2005 (9/14/2005 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 08/01/2005 **# of Pages:** 3
File Break: 03.06
Doc Type: REPORT

273554 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) SEPTEMBER 2005 (10/14/2005 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 09/01/2005 **# of Pages:** 4
File Break: 03.06
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

273527 **REVIEW BY EPA OF RESPONSE TO COMMENTS ON THE MARCH 2005 DRAFT PHASE 1A REMEDIAL INVESTIGATION (RI) DELIVERABLE**

Author: US EPA REGION 1
Addressee:
Doc Type: MEMO
Doc Date: 09/22/2005 **# of Pages:** 9
File Break: 03.06

273528 **COMMENTS ON THE "RESPONSE TO COMMENTS ON THE MARCH 2005 DRAFT PHASE 1A REMEDIAL INVESTIGATION (RI) DELIVERABLE"**

Author: US EPA REGION 1
Addressee:
Doc Type: LETTER
Doc Date: 09/22/2005 **# of Pages:** 3
File Break: 03.06

273555 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) OCTOBER 2005 (11/14/2005 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Type: REPORT
Doc Date: 10/01/2005 **# of Pages:** 3
File Break: 03.06

273556 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) NOVEMBER 2005 (12/14/2005 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Type: REPORT
Doc Date: 11/01/2005 **# of Pages:** 4
File Break: 03.06

03: REMEDIAL INVESTIGATION (RI)

273557 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) DECEMBER 2005 (1/14/2006 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Doc Date: 12/01/2005 **# of Pages:** 3
Addressee: DON MCELROY US EPA REGION 1
File Break: 03.06
Doc Type: REPORT

273558 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) JANUARY 2006 (2/14/2006 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Doc Date: 01/01/2006 **# of Pages:** 3
Addressee: DON MCELROY US EPA REGION 1
File Break: 03.06
Doc Type: REPORT

273559 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) FEBRUARY 2006 (3/14/2006 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Doc Date: 02/01/2006 **# of Pages:** 3
Addressee: DON MCELROY US EPA REGION 1
File Break: 03.06
Doc Type: REPORT

273560 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) MARCH 2006 (4/14/2006 TRANSMITTAL ATTACHED)**

Author: KARL D KASPAR WOODARD & CURRAN
Doc Date: 03/01/2006 **# of Pages:** 3
Addressee: DON MCELROY US EPA REGION 1
File Break: 03.06
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

273561 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) APRIL 2006 (5/12/2006 TRANSMITTAL ATTACHED)**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Addressee: KARL D KASPAR WOODARD & CURRAN
DON MCELROY US EPA REGION 1
Doc Date: 04/01/2006 **# of Pages:** 3
File Break: 03.06
Doc Type: REPORT

273562 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) MAY 2006 (6/14/2006 TRANSMITTAL ATTACHED)**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Addressee: KARL D KASPAR WOODARD & CURRAN
DON MCELROY US EPA REGION 1
Doc Date: 05/01/2006 **# of Pages:** 3
File Break: 03.06
Doc Type: REPORT

273563 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) JUNE 2006 (7/14/2006 TRANSMITTAL ATTACHED)**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 06/01/2006 **# of Pages:** 3
File Break: 03.06
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

273564 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) JULY 2006 (8/14/2006 TRANSMITTAL ATTACHED)**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 07/01/2006 **# of Pages:** 3
File Break: 03.06
Doc Type: REPORT

273565 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) AUGUST 2006 (9/15/2006 TRANSMITTAL ATTACHED)**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 08/01/2006 **# of Pages:** 3
File Break: 03.06
Doc Type: REPORT

273566 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) SEPTEMBER 2006 (10/13/2006 TRANSMITTAL ATTACHED)**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 09/01/2006 **# of Pages:** 3
File Break: 03.06
Doc Type: REPORT

273567 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) OCTOBER 2006 (11/14/2006 TRANSMITTAL ATTACHED)**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 10/01/2006 **# of Pages:** 3
File Break: 03.06
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

273568 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) NOVEMBER 2006 (12/14/2006 TRANSMITTAL ATTACHED)**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Doc Date: 11/01/2006 **# of Pages:** 3
Addressee: DON MCELROY US EPA REGION 1
File Break: 03.06
Doc Type: REPORT

273569 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) DECEMBER 2006 (1/12/2007 TRANSMITTAL ATTACHED)**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Doc Date: 12/01/2006 **# of Pages:** 3
Addressee: DON MCELROY US EPA REGION 1
File Break: 03.06
Doc Type: REPORT

273532 **TECHNICAL MEMORANDUM, NOVEMBER 2006 SEDIMENT SAMPLE COLLECTION - SOUTHERN TRIBUTARY**

Author: WOODARD & CURRAN
Doc Date: 12/05/2006 **# of Pages:** 23
Addressee:
File Break: 03.02
Doc Type: REPORT

273570 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) JANUARY 2007 (2/14/2007 TRANSMITTAL ATTACHED)**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Doc Date: 01/01/2007 **# of Pages:** 19
Addressee: DON MCELROY US EPA REGION 1
File Break: 03.06
Doc Type: REPORT

03: REMEDIAL INVESTIGATION (RI)

273531 **TECHNICAL MEMORANDUM, NOVEMBER 2006 SEDIMENT SAMPLE COLLECTION - DEEP MARSH**

Author: WOODARD & CURRAN
Addressee:
Doc Type: REPORT
Doc Date: 01/08/2007 **# of Pages:** 27
File Break: 03.02

273530 **TOXICITY TEST RESULTS - SOUTHERN TRIBUTARY SEDIMENTS**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Type: SAMPLING DATA
Doc Date: 01/18/2007 **# of Pages:** 2
File Break: 03.02

273519 **SAMPLING DATA FOR 19 BEMIS CIRCLE**

Author: PAUL GIDDINGS MA DEPARTMENT OF ENVIRONMENTAL PROTECTION - COMMISSIONER
Addressee:
Doc Type: SAMPLING DATA
Doc Date: 01/29/2007 **# of Pages:** 25
File Break: 02.03

273571 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) FEBRUARY 2007 (3/15/2007 TRANSMITTAL ATTACHED)**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Type: REPORT
Doc Date: 02/01/2007 **# of Pages:** 3
File Break: 03.06

03: REMEDIAL INVESTIGATION (RI)

273576 **REMEDIAL INVESTIGATION AND FEASIBILTY STUDY (RI/FS), VOLUME 1 OF 5, REMEDIAL INVESTIGATION (RI) REPORT**

Author: WOODARD & CURRAN
Doc Date: 02/01/2007 **# of Pages:** 342
Addressee:
File Break: 03.06
Doc Type: REM INVEST/FS STUDY (RI/FS)
REMEDIAL INVESTIGATION (RI) REPORT

273577 **REMEDIAL INVESTIGATION AND FEASIBILTY STUDY (RI/FS), VOLUME 2 OF 5, REMEDIAL INVESTIGATION (RI) REPORT, APPENDICES**

Author: WOODARD & CURRAN
Doc Date: 02/01/2007 **# of Pages:** 3244
Addressee:
File Break: 03.06
Doc Type: REM INVEST/FS STUDY (RI/FS)
REMEDIAL INVESTIGATION (RI) REPORT

273533 **COMMENTS ON "TRANSMITTAL OF TOXICITY TEST RESULTS - TRIBUTARY SEDIMENTS"**

Author: DON MCELROY US EPA REGION 1
Doc Date: 02/06/2007 **# of Pages:** 1
Addressee:
File Break: 03.02
Doc Type: MEMO

03: REMEDIAL INVESTIGATION (RI)

273521 **COMMENTS FOR TRANSMITTAL TO NATIONAL REMEDY REVIEW BOARD**

Author: RICH DOHERTY ENGINEERING & CONSULTING RESOURCES, INC
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 03/01/2007 **# of Pages:** 10
File Break: 03.06
Doc Type: LETTER

273529 **REVIEW BY EPA OF THE REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) BASELINE RISK ASSESSMENT (HUMAN HEALTH RISK ASSESSMENT (HHRA) PORTION)**

Author: US EPA REGION 1
Addressee:
Doc Date: 03/01/2007 **# of Pages:** 6
File Break: 03.10
Doc Type: MEMO

273572 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) MARCH 2007 (4/12/2007 TRANSMITTAL ATTACHED)**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 03/01/2007 **# of Pages:** 3
File Break: 03.06
Doc Type: REPORT

273522 **COMMENTS OF PERFORMING PRPS RELATING TO REMEDY REVIEW BOARD PROCESS**

Author: SUTTON BROOK SITE PERFORMING PRPS
Addressee: NATIONAL REMEDY REVIEW BOARD
Doc Date: 03/27/2007 **# of Pages:** 10
File Break: 03.06
Doc Type: MEMO

03: REMEDIAL INVESTIGATION (RI)

273523 **REMEDY REVIEW BOARD PACKAGE**

Author: JAY NAPARSTEK MA DEPT OF ENVIRONMENTAL PROTECTION
Doc Date: 03/27/2007 **# of Pages:** 2
Addressee: DON MCELROY US EPA REGION 1
File Break: 03.06
Doc Type: LETTER

273573 **MONTHLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) APRIL 2007 (5/14/2007 TRANSMITTAL ATTACHED)**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Doc Date: 04/01/2007 **# of Pages:** 4
Addressee: DON MCELROY US EPA REGION 1
File Break: 03.06
Doc Type: REPORT

273578 **REMEDIAL INVESTIGATION AND FEASIBILTY STUDY (RI/FS), VOLUME 3 OF 5, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) BASELINE RISK ASSESSMENT**

Author: WOODARD & CURRAN
Doc Date: 05/01/2007 **# of Pages:** 499
Addressee:
File Break: 03.10
Doc Type: REMEDIAL INVESTIGATION (RI)
REM INVEST/FS STUDY (RI/FS)
REPORT

03: REMEDIAL INVESTIGATION (RI)

273579 **REMEDIAL INVESTIGATION AND FEASIBILTY STUDY (RI/FS), VOLUME 4 OF 5, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) BASELINE RISK ASSESSMENT, APPENDICES**

Author: WOODARD & CURRAN
Addressee:
Doc Date: 05/01/2007 **# of Pages:** 2834
File Break: 03.10
Doc Type: REM INVEST/FS STUDY (RI/FS)
REMEDIAL INVESTIGATION (RI)
REPORT

04: FEASIBILITY STUDY (FS)

273537 **RESPONSES TO EPA'S MARCH 14, 2007 COMMENTS ON THE PHASE 2 FEASIBILITY STUDY (FS)**

Author: WOODARD & CURRAN
Addressee:
Doc Date: 01/01/1111 **# of Pages:** 9
File Break: 04.06
Doc Type: MEMO

273534 **REVIEW BY EPA OF PHASE 1 FEASIBILITY STUDY (FS) DEVELOPMENT AND INITIAL SCREENING OF ALTERNATIVES REPORT**

Author: US EPA REGION 1
Addressee:
Doc Date: 09/22/2006 **# of Pages:** 7
File Break: 04.06
Doc Type: MEMO

04: FEASIBILITY STUDY (FS)

273536 **RESPONSES TO COMMENTS ON THE PHASE 1 FEASIBILITY STUDY (FS) DEVELOPMENT AND INTIAL SCREENING OF ALTERNATIVES REPORT**

Author: JEFFREY A HAMEL WOODARD & CURRAN
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 12/15/2006 **# of Pages:** 72
File Break: 04.06
Doc Type: LETTER

273535 **REVIEW OF PHASE 2 FEASIBILITY STUDY (FS) DETAILED ANALYSIS OF ALTERNATIVE REPORT**

Author: US EPA REGION 1
Addressee:
Doc Date: 03/01/2007 **# of Pages:** 4
File Break: 04.06
Doc Type: MEMO

273580 **REMEDIAL INVESTIGATION AND FEASIBILTY STUDY (RI/FS), VOLUME 5 OF 5, FEASIBILITY STUDY (FS)**

Author: WOODARD & CURRAN
Addressee:
Doc Date: 05/01/2007 **# of Pages:** 414
File Break: 04.06
Doc Type: REPORT
REM INVEST/FS STUDY (RI/FS)
FEASIBILITY STUDY (FS)

04: FEASIBILITY STUDY (FS)

273525 **PROPOSED PLAN**

Author: US EPA REGION 1
Addressee:
Doc Date: 06/01/2007 **# of Pages:** 26
File Break: 04.09
Doc Type: PROPOSED PLAN
REPORT

05: RECORD OF DECISION (ROD)

278200 **RESPONSES TO NATIONAL REMEDY REVIEW BOARD (NRRB) RECOMMENDATIONS**

Author: DON MCELROY US EPA REGION 1
Addressee: DAVID E COOPER US EPA
Doc Date: 06/18/2007 **# of Pages:** 6
File Break: 05.03
Doc Type: MEMO

278203 **COMMENTS ON PROPOSED PLAN**

Author: ROBERT FOWLER TEWKSBURY (MA) TOWN OF
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 07/10/2007 **# of Pages:** 2
File Break: 05.03
Doc Type: LETTER

05: RECORD OF DECISION (ROD)

278214 **COMMENTS ON PROPOSED PLAN**

Author: DOUGLAS W SEARS TEWKSBURY (MA) RESIDENT
Addressee: DON MCELROY US EPA REGION 1
Doc Type: LETTER
Doc Date: 07/24/2007 **# of Pages:** 2
File Break: 05.03

278215 **COMMENTS ON PROPOSED PLAN**

Author: ROBERT BRIGGS TEWKSBURY (MA) TOWN OF - BOARD OF HEALTH
Addressee: PHILLIP FRENCH TEWKSBURY (MA) TOWN OF - BOARD OF HEALTH
CHRISTINE KINNON TEWKSBURY (MA) TOWN OF - BOARD OF HEALTH
RALPH MCHATTON TEWKSBURY (MA) TOWN OF - BOARD OF HEALTH
EDWARD SHEEHAN TEWKSBURY (MA) TOWN OF - BOARD OF HEALTH
DON MCELROY US EPA REGION 1
Doc Type: LETTER
Doc Date: 07/25/2007 **# of Pages:** 1
File Break: 05.03

278217 **COMMENTS ON PROPOSED PLAN**

Author: JAMES R MICELI MA SENATE
Addressee: DON MCELROY US EPA REGION 1
Doc Type: MEMO
Doc Date: 07/26/2007 **# of Pages:** 2
File Break: 05.03

05: RECORD OF DECISION (ROD)

278201 **COMMENTS ON PROPOSED PLAN**

Author: RICH DOHERTY ENGINEERING & CONSULTING RESOURCES, INC
Addressee: TOXIC INC
DON MCELROY US EPA REGION 1
Doc Type: LETTER

Doc Date: 07/27/2007 **# of Pages:** 9
File Break: 05.03

278216 **COMMENTS ON PROPOSED PLAN**

Author: SCOTT DARLING III MASSACHUSETTS BAY TRANSPORTATION AUTHORITY
Addressee: DON MCELROY US EPA REGION 1
Doc Type: LETTER

Doc Date: 07/27/2007 **# of Pages:** 5
File Break: 05.03

278211 **COMMENTS ON PROPOSED PLAN**

Author: CHARLES HOLMES TEWKSBURY (MA) RESIDENT
Addressee: DON MCELROY US EPA REGION 1
Doc Type: LETTER

Doc Date: 07/28/2007 **# of Pages:** 1
File Break: 05.03

05: RECORD OF DECISION (ROD)

278209 **COMMENTS ON PROPOSED PLAN**

Author: ROBERT C KIRSCH WILMER CUTLER PICKERING HALE & DORR
Addressee: DON MCELROY US EPA REGION 1
Doc Type: LETTER
Doc Date: 07/30/2007 **# of Pages:** 8
File Break: 05.03

278202 **COMMENTS ON PROPOSED PLAN**

Author: JAY NAPARSTEK MA DEPT OF ENVIRONMENTAL PROTECTION
Addressee: DON MCELROY US EPA REGION 1
Doc Type: LETTER
Doc Date: 07/31/2007 **# of Pages:** 2
File Break: 05.03

278221 **RECORD OF DECISION (ROD)**

Author: US EPA REGION 1
Addressee:
Doc Type: RECORD OF DECISION (ROD)
DECISION DOCUMENT
REPORT
Doc Date: 09/27/2007 **# of Pages:** 291
File Break: 05.04

05: RECORD OF DECISION (ROD)

278210 **COMMENTS ON PROPOSED PLAN**

Author: BILL CONNORS TEWKSBURY (MA) RESIDENT
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 01/01/9999 **# of Pages:** 1
File Break: 05.03
Doc Type: LETTER

278212 **COMMENTS ON PROPOSED PLAN**

Author: TIMOTHY SHEA TEWKSBURY (MA) RESIDENT
Addressee: DON MCELROY US EPA REGION 1
Doc Date: 01/01/9999 **# of Pages:** 1
File Break: 05.03
Doc Type: LETTER

278213 **COMMENTS ON PROPOSED PLAN**

Author: JAYNE MILLER TEWKSBURY (MA) RESIDENT
Addressee: PETER L MILLER III TEWKSBURY (MA) RESIDENT
DON MCELROY US EPA REGION 1
Doc Date: 01/01/9999 **# of Pages:** 1
File Break: 05.03
Doc Type: LETTER

13: COMMUNITY RELATIONS

275026 **PUBLIC NOTICE - PROPOSED CLEANUP PLAN**

Author: US EPA REGION 1
Addressee:
Doc Date: 06/15/2007 **# of Pages:** 2
File Break: 13.03
Doc Type: PRESS RELEASE
PUBLIC NOTICE

277698 **TRANSCRIPT OF THE PUBLIC MEETING HELD JULY 18, 2007**

Author: US EPA REGION 1
Addressee:
Doc Date: 07/18/2007 **# of Pages:** 14
File Break: 13.04
Doc Type: PUBLIC MEETING RECORD

14: CONGRESSIONAL RELATIONS

278204 **CONCERNS OVER LACK OF LARGER PRP GROUP AND ACCESS TO SITE**

Author: JEROME E SELISSEN TEWKSBURY (MA) TOWN OF
Addressee: EDWARD M KENNEDY US SENATE
Doc Date: 07/25/2007 **# of Pages:** 2
File Break: 14.01
Doc Type: LETTER

14: CONGRESSIONAL RELATIONS

278205 **CONCERNS OVER LACK OF LARGER PRP GROUP AND ACCESS TO SITE**

Author: JEROME E SELISSEN TEWKSBURY (MA) TOWN OF **Doc Date:** 07/26/2007 **# of Pages:** 2
Addressee: JOHN F KERRY US SENATE **File Break:** 14.01
Doc Type: LETTER

278206 **CONCERNS OVER LACK OF LARGER PRP GROUP AND ACCESS TO SITE**

Author: JEROME E SELISSEN TEWKSBURY (MA) TOWN OF **Doc Date:** 07/26/2007 **# of Pages:** 2
Addressee: BARRY R FINEGOLD MA HOUSE OF REPRESENTATIVES **File Break:** 14.01
Doc Type: LETTER

278207 **CONCERNS OVER LACK OF LARGER PRP GROUP AND ACCESS TO SITE**

Author: JEROME E SELISSEN TEWKSBURY (MA) TOWN OF **Doc Date:** 07/26/2007 **# of Pages:** 2
Addressee: JAMES R MICELI MA SENATE **File Break:** 14.01
Doc Type: LETTER

14: CONGRESSIONAL RELATIONS

278208 **CONCERNS OVER LACK OF LARGER PRP GROUP AND ACCESS TO SITE**

Author: JEROME E SELISSEN TEWKSBURY (MA) TOWN OF
Addressee: SUSAN TUCKER MA SENATE
Doc Type: LETTER
Doc Date: 07/26/2007 **# of Pages:** 2
File Break: 14.01

Number of Documents in Collection: 81

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
INTERIM FINAL GUIDANCE FOR CONDUCTING REMEDIAL INVESTIGATIONS AND FEASIBILITY STUDIES UNDER CERCLA.

DOCDATE	OSWER/EPA ID	DOCNUMBER
10/1/1988	OSWER #9355.3-01	2002

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND, VOLUME II, ENVIRONMENTAL EVALUATION MANUAL

DOCDATE	OSWER/EPA ID	DOCNUMBER
3/1/1989	EPA/540/1-89/001	5024

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND. VOLUME I. HUMAN HEALTH EVALUATION MANUAL (PART A). INTERIM FINAL.

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/1989	EPA 540/1-89/002	C174

TITLE
STREAMLINING THE RI/FS FOR CERCLA MUNICIPAL LANDFILL SITES.

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/1/1990	OSWER 9355.3-11FS	C176

TITLE
CONDUCTING REMEDIAL INVESTIGATIONS/FEASIBILITY STUDIES FOR CERCLA MUNICIPAL LANDFILL SITES.

DOCDATE	OSWER/EPA ID	DOCNUMBER
2/1/1991	OSWER 9355.3-11	C177

TITLE
ECOLOGICAL ASSESSMENT OF HAZARDOUS WASTE SITES: A FIELD AND LABORATORY REFERENCE.

DOCDATE	OSWER/EPA ID	DOCNUMBER
3/1/1989	EPA 600/3-89/013	C251

TITLE
ECO UPDATE. ECOTOX THRESHOLDS. INTERMITTENT BULLETIN VOLUME 3, NUMBER 2

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1996	OSWER 9345.0-12FSI	C269

TITLE
LAND USE IN THE CERCLA REMEDY SELECTION PROCESS

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1995	OSWER 9355.7-04	C317

TITLE
EXPOSURE FACTORS HANDBOOK; GENERAL FACTORS, VOLUME I

DOCDATE	OSWER/EPA ID	DOCNUMBER
8/1/1997	EPA 600/P-95/002FA	C356

TITLE
ECOLOGICAL RISK ASSESSMENT GUIDANCE FOR SUPERFUND PROCESS FOR DESIGNING AND CONDUCTING ECOLOGICAL RISK ASSESSMENTS (EPA 540-R-97-006)

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/2/1997		C361

TITLE
FRAMEWORK FOR ECOLOGICAL RISK ASSESSMENT (EPA/630/R-92/001)

DOCDATE	OSWER/EPA ID	DOCNUMBER
2/1/1992	EPA 630/R-92-001	C364

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
DRAFT FINAL GUIDELINES FOR ECOLOGICAL RISK ASSESSMENT

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/18/1997		C366

TITLE
FRAMEWORK FOR ECOLOGICAL RISK ASSESSMENT AT THE EPA

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1992		C396

TITLE
ROLE OF BTAG'S IN ECOLOGICAL ASSESSMENT -ECO UPDATE - VOL. 1, NO. 1

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/1/1991	OSWER 9345.0-05I	C416

TITLE
HEALTH EFFECTS ASSESSMENT SUMMARY TABLES - FY 1997 UPDATE

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1997	EPA 540/R-97-036	C468

TITLE
DERMAL EXPOSURE ASSESSMENT: PRINCIPLES AND APPLICATIONS

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1992	EPA 600/8-91-011B	C469

TITLE
DRAFT INTERIM FINAL OSWER MONITORED NATURAL ATTENUATION POLICY

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/1997	OSWER 9200.4-17	C474

TITLE
LETTER AND ATTACHED MEMORADUM OF AGREEMENT BETWEEN U.S. EPA AND MASS DEP FOR IMPLEMENTATION OF GROUND WATER USE AND VALUE DETERMINATION GUIDANCE

DOCDATE	OSWER/EPA ID	DOCNUMBER
3/23/1998		C477

TITLE
PRESUMPTIVE REMEDIES: SITE CHARACTERIZATION AND TECHNOLOGY SELECTION FOR CERCLA SITES WITH VOLATILE ORGANIC COMPOUNDS IN SOILS

DOCDATE	OSWER/EPA ID	DOCNUMBER
9/1/1993	OSWER 9355.0-48FS	C491

TITLE
EXPOSURE FACTORS HANDBOOK; FOOD INGESTION FACTORS, VOLUME II

DOCDATE	OSWER/EPA ID	DOCNUMBER
8/1/1997	EPA/600/P-95/002FB	C501

TITLE
EXPOSURE FACTORS HANDBOOK; ACTIVITY FACTORS, VOLUME III

DOCDATE	OSWER/EPA ID	DOCNUMBER
8/1/1997	EPA/600/P-95/002FC	C502

TITLE
USE OF MONITORED NATURAL ATTENTUATION AT SUPERFUND, RCRA CORRECTIVE ACTION, AND UNDERGROUND STORAGE TANK SITES

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/21/1999	OSWER 9200.4-17P	C515

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
REVISED ALTERNATIVE CAP DESIGN GUIDANCE PROPOSED FOR UNLINED HAZARDOUS WASTE LANDFILLS IN THE EPA REGION I

DOCDATE	OSWER/EPA ID	DOCNUMBER
2/5/2001		C524

TITLE
GUIDE TO PREPARING SUPERFUND PROPOSED PLANS RECORDS OF DECISION AND OTHER REMEDY SELECTION DECISION DOCUMENTS

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1999	OSWER 9200.1-23P	C525

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND, VOLUME 1, HUMAN HEALTH EVALUATION MANUAL, INTERIM

DOCDATE	OSWER/EPA ID	DOCNUMBER
1/1/1998	OSWER 9285.7-01D	C530

TITLE
WILDLIFE EXPOSURE FACTORS HANDBOOK, VOLUME 2 OF 2

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/1993	EPA 600/R-93/187	C567

TITLE
SOIL SCREENING GUIDANCE: USER'S GUIDE

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/1996	OSWER NO. 9355.4-23	C577

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND VOLUME I: HUMAN HEALTH EVALUATION MANUAL. PART D. STANDARDIZED PLANNING, REPORTING, AND REVIEW OF SUPERFUND RISK ASSESSMENTS. FINAL

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/2001		C593

TITLE
CALCULATING UPPER CONFIDENCE LIMITS FOR EXPOSURE POINT CONCENTRATIONS AT HAZARDOUS WASTE SITES

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/2002		C596

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND VOLUME I: HUMAN HEALTH EVALUATION MANUAL (PART E SUPPLEMENTAL GUIDANCE FOR DERMAL RISK ASSESSMENT) FINAL

DOCDATE	OSWER/EPA ID	DOCNUMBER
7/1/2004		C602

TITLE
GUIDELINES FOR ECOLOGICAL RISK ASSESSMENT

DOCDATE	OSWER/EPA ID	DOCNUMBER
4/1/1998		C614

TITLE
RISK ASSESSMENT GUIDANCE FOR SUPERFUND. VOL 1. HUMAN HEALTH EVALUATION MANUAL (PART B, DEVELOPMENT OF RISK-BASED PRELIMINARY REMEDIATION GOALS) INTERIM

DOCDATE	OSWER/EPA ID	DOCNUMBER
12/1/1991	OSWER 9285.6-03	C644

TITLE
GUIDANCE FOR CHARACTERIZING BACKGROUND CHEMICALS IN SOIL AT SUPERFUND SITES EXTERNAL REVIEW DRAFT

DOCDATE	OSWER/EPA ID	DOCNUMBER
6/1/2001	OSWER 9285.7-41	C645

EPA Region 1 AR Compendium GUIDANCE DOCUMENTS

EPA guidance documents may be reviewed at the EPA Region I Superfund Records Center in Boston, Massachusetts.

TITLE
ISSUANCE OF FINAL GUIDANCE: ECOLOGICAL RISK ASSESSMENT AND RISK MANAGEMENT PRINCIPLES FOR SUPERFUND SITES

DOCDATE	OSWER/EPA ID	DOCNUMBER
10/7/1999	OSWER 9285.7-28 P	C646